



Doctoral Course in Chemical, Geological and Environmental Sciences



Cycle 40th
a.y. 2024/2025



*Handbook for Ph.D.
Students @ DISAT*

Our vision

The SCGA Doctoral Course intends to develop the interaction between research areas in the Chemical, Geological and Environmental Sciences on various topics including climate change, sustainability, planet Earth and technological development. The training path enhances the students' ability to plan, organize, manage, and execute research activities according to international standards. The course is organized into 3 curricula with complementary purposes:

1 **CHEMICAL SCIENCES:** Chemistry applied to the prevention and solution of environmental problems; Chemistry applied to the development of materials; Chemistry of bioactive compounds.

2 **GEOLOGICAL SCIENCES:** Geosciences and geosciences applied to the defense of the environment, the territory, and its resources; study of the Earth system, petrogenetic processes, climate changes and natural and geological risks also connected to anthropic activities.

3 **TERRESTRIAL AND MARINE ENVIRONMENTAL SCIENCES:** Knowledge of the terrestrial and marine environment in its various components and their interactions and integrations; assessment and prevention of risks for humans and the environment deriving from human activities; development of innovative methodologies and technologies for the restoration and conservation of the terrestrial and marine environment and for the protection of biodiversity.

The peculiar characteristics of the Doctoral Course in Chemical, Geological and Environmental Sciences are multidisciplinary and interdisciplinarity. In the doctoral activities, developed through the synergy of three Departments (DISAT, BtBs, Materials Science), fundamental scientific disciplines such as chemistry, physics, geology and biology find possibilities and opportunities for integration and collaboration, while at the same time maintaining intact their cultural integrity. The course has a consolidated tradition in the creation of innovative paths in collaboration with companies, through project-funded scholarships and doctoral courses in high apprenticeship. The highly multidisciplinary nature of the Doctoral Course offers doctoral students the possibility of continuous comparison and exchange with different scientific cultural realities, while maintaining a high level of specialization in the specific topic of the individual curriculum. The 46 laboratories and research centers of DISAT (<https://www.disat.unimib.it/it/ricerca/laboratori>) and the numerous research laboratories of the BtBs and Materials Science departments provide doctoral students with cutting-edge equipment in the various fields of chemical, geological and environmental sciences for carrying out the doctoral project.

The teaching offer, delivered in English, is specific for doctoral students. There are interdisciplinary courses offered by the University Doctoral School and a large offer of specific inter-curricular and curricular teachings, as well as seminar activities, which allow doctoral students to build personalized educational paths. The offer is uploaded to Moodle – eLearning platform to optimize its usability.

The PhD student's activity is supervised by a tutor in charge of following and directing his/her training and research and by one or more supervisors, chosen by the Teaching Board also from among external subjects, with the task of following and directing the research and writing activities aimed at compiling the doctoral thesis. The supervision of doctoral students of courses carried out in collaboration with companies sees the active participation of company tutors. The Teaching Board includes both internal members of the university and members belonging to foreign university institutions.

Course objectives

The Doctoral Course in Chemical, Geological and Environmental Sciences aims to provide the skills necessary to analyze complex processes in the specific areas of the curricula into which the doctoral course is divided, operating with advanced data collection, analysis, and modeling techniques and with innovative and quantitative approaches in order to develop effective proposals for sustainable development. The learning of cutting-edge analytical techniques, together with the development of the ability to compare and exchange with different scientific cultural realities, constitute fundamental elements to facilitate the application of the skills acquired to the dynamic and rapidly evolving contexts that characterize the Chemical Sciences, Geological and Environmental both in their more traditional fields and in the fields more linked to aspects of environmental sustainability. The doctoral course intends to guarantee an international connotation to the training path, thanks to the carrying out of part of the research project at universities and research institutions abroad and to the involvement of professors from foreign universities, also with the aim of increasing the possibilities of a future employment placement in an international context of advanced research. The doctoral course also offers doctoral students valuable opportunities for practical experience thanks to the development of innovative paths in collaboration with companies and the alignment of research projects to real-world challenges.

The specific technical-scientific skills, ensured by a structured and complete educational offer at a disciplinary level conceived from a multidisciplinary perspective, are always integrated by the development of soft skills and transversal skills thanks to courses and laboratories that aim to provide doctoral students with tools to deal with the entire research valorization chain, from responsible research to technology transfer, research entrepreneurship and public engagement. Openness towards the socio-economic context also takes the form of initiatives with socio-cultural and educational value, through public engagement with particular attention to interaction with secondary schools.

Expected employment and professional opportunities

Once doctoral training has been completed, PhDs in Chemical, Geological and Environmental Sciences will be able to promote the advancement of scientific and technological knowledge both in the academic and extra-academic fields. The combination of multidisciplinary and specific skills, and the versatility acquired during the doctoral path will allow the carrying out of research activities in universities or in public and private research centers in the various areas that fall within the disciplines of Chemical, Geological and Environmental Sciences. In this context, PhDs in Chemical, Geological and Environmental Sciences will be able to make use of their ability to analyze complex processes, operating with advanced data collection, analysis, and modeling techniques and with innovative and quantitative approaches. The skills achieved during the training course within the entire research valorization chain, from responsible research to technological transfer and public engagement, will allow new doctors to build synergies with the industrial ecosystem in order to develop effective proposals for sustainable development. New doctors will also be able to hold managerial roles in extra-academic contexts, in public and private institutions, in the specific areas of the curricula into which the doctoral course is divided.

The possibilities of employment placement are increased by the international and highly multidisciplinary connotation of the training course, also thanks to the network of relationships and interactions developed during the period spent abroad at Universities and Research Institutions. The possibilities for professional placement in the industrial sector are maximized thanks to the creation of innovative paths in collaboration with companies. Solid employment prospects are favored by the relevance of the training courses with the strategic themes and missions of the PNRR, particularly for aspects linked to environmental sustainability and sustainable development.

Strategic perspective

The challenges posed by climate change and the progressive depletion of natural resources require a green transition that is associated with effective decarbonization and new circular economy models. In this context, new professionals are needed who are able to contribute to the resolution of the main scientific-technological challenges recognized globally (e.g. EU Priorities, Sustainable Development Goals), and who know how to address the problems related to the environmental and energy transition in a perspective of innovation, efficiency and circularity.

The strategic vision of the PhD in Chemical, Geological and Environmental Sciences is to train researchers and professionals capable of effectively implementing a green transition in the context of a constantly evolving market, and in the context of a growing interaction between scientific disciplines. The researcher of the future that the doctoral course intends to train must be able, in line with the objectives of the University Strategic Plan 2023-2025, to build synergies with the industrial ecosystem of the territory to promote development and innovation, while at the same time seizing the opportunities offered by the possibility of operating in an international context. She/he must possess the necessary skills to interact positively with industry and citizens, in order to generate public value and a social impact on the territory by proposing solutions that aim at a greater quality of environmental and social life. Her/his cultural profile therefore requires an interdisciplinary specialization characterized by the combination of cutting-edge technical-scientific skills and transversal skills to be acquired in an international training context. Of particular importance are therefore the activities aimed at encouraging the internationalization of the teaching bodies, the mobility of doctoral students and the international attractiveness of the training proposal, which the Doctoral Course in Chemical, Geological and Environmental Sciences promotes decisively in line with the University Strategic Plan. In this context, the calls for interest which describe possible research projects within the positions advertised are widely advertised on the departmental website and on the websites and newsletters of scientific societies. The drafting and discussion of theses in English, the possibility of taking the entrance exam via videoconference, the presentation of a research project in English when submitting the application for admission, and support for co-tutorship in collaboration with prestigious foreign universities aimed at issuing the double qualification, contribute to strengthening the international dimension of the course.

To ensure that future PhDs are able to undertake a professional path in line with the evolution of the disciplines of Chemical, Geological and Environmental Sciences, the doctoral course offers, through DISAT and the other UNIMIB Departments involved, cutting-edge equipment and laboratories. DISAT supports the expenses for doctoral students' analyses carried out in Department labs. The University Central Library provides a large collection of books and access to the main journals and databases in the field of chemical, geological and environmental sciences. Doctoral students have the possibility to use advanced software for applications in the different sectors covered by the doctorate and have access to clusters for parallel computing.

Websites: <https://www.disat.unimib.it/en/research/phd-course>
<https://en.unimib.it/education/doctoral-research-phd-programmes>

This Handbook aims to collect, organize, and forward information useful for each Ph.D. student at DISAT (information about how applying for a Ph.D. position is not included here). The content, as well as the structure of this handbook, are updated and amended whenever required. The handbook is also available on the departmental website, making it easily accessible to PhD students and their supervisors (<https://www.disat.unimib.it/en/study/phd-chemical-geological-and-environmental-sciences/useful-forms>). All the deadlines that are reported refer to Ph.D. courses that start in November. The timelines for ITN Marie Skłodowska Curie Ph.D. programs depend on the starting date.

The Ph.D. Course in Chemical, Geological, and Environmental Sciences is organized in three Curricula:

- Chemical Sciences
- Geological Sciences
- Terrestrial and Marine Environmental Sciences

Each student will be part of a curriculum. He/she will be followed by a Tutor belonging to that curriculum + one or more Supervisors. The Tutor monitors the student activities and acts as a referent in the Teaching Board. The supervisor follows the research activity of the student, including the thesis. The Tutor must be part of the Teaching Board but not necessarily working on the thesis subject.

The official language of the Course is English.

The teachers of the curricula in Geological Sciences and Terrestrial and Marine Environmental Sciences are part of the Department of Geological and Environmental Sciences (DISAT). The teachers of the curriculum in Chemical Sciences belong to DISAT and the Departments of Biotechnologies and Biosciences (BtBs) and Material Sciences (MATER).

Coordinator: Prof. Marco Giovanni Malusà (marco.malusa@unimib.it)

Responsible for the Curriculum in Chemical Sciences (and deputy director):

Prof. Davide Ballabio (davide.ballabio@unimib.it)

Responsible for the Curriculum in Geological Sciences:

Prof. Federico Agliardi (federico.agliardi@unimib.it)

Responsible for the Curriculum in Terrestrial and Marine Environmental Sciences:

Prof. Andrea Franzetti (andrea.franzetti@unimib.it)

Responsible for the Quality Assurance of the SCGA Doctoral Course

Prof.ssa Chiara Urani (chiara.urani@unimib.it)

Secretary: Matilde Giberti (matilde.giberti@unimib.it)

The organizational structure of the SCGA doctorate provides that the Secretary (matilde.giberti@unimib.it) is the entry point for requests for information from doctoral students. Dr. Giberti responds directly to the requests of doctoral students or forwards them, depending on the needs, to the Coordinator, the Responsible of each curriculum, or to the Doctoral School (dottorati@unimib.it).

Teaching Board (40th cycle)

Curriculum in Chemical Sciences

BALLABIO Davide (CHEM-01/A)
FERRERO Luca (CHEM-01/B)
GAGLIARDI Laura (CHEM-02/A)
GRECO Claudio (CHEM-02/A)
MUSTARELLI Piercarlo (CHEM-02/A)
RAY Kallol (CHEM-03/A)
REIHER Markus (CHEM-05/A)
ZAMPELLA Giuseppe (CHEM-03/A)
ZOIA Luca (CHEM-05/A)

Curriculum in Geological Sciences

AGLIARDI Federico (GEOS-03/B)
BODNAR Robert J. (GEOS-01/B)
CROSTA Giovanni Battista (GEOS-03/B)
DELMONTE Barbara (GEOS-03/A)
GARZANTI Eduardo Aldo Franco (GEOS-02/B)
JABOYEDOFF Michel (GEOS-03/A)
MALUSA' Marco Giovanni (GEOS-02/B)
PIANA AGOSTINETTI Nicola (GEOS-04/B)
ZANCHI Andrea Marco (GEOS-02/C)

Curriculum in Terrestrial and Marine Environmental Sciences

BASSO Daniela Maria (GEOS-02/A)
CITTERIO Sandra (BIOS-01/A)
FINIZIO Antonio (BIOS-05/A)
FRANZETTI Andrea (BIOS-15/A)
FULLANA Andres (CHEM-01/B)
NAGENDRA Harini (BIOS-03/A)
PASQUERO Claudia (GEOS-04/C)
SEEGER Michael (BIOS-15/A)
URANI Chiara (BIOS-04/A)

Presentation of the research project

Within one month after starting the activities, each PhD student must submit the research project in agreement with the supervisor(s) and tutor. The project (3-5 pages) must be sent to the Coordinator and the Responsible for the specific curriculum in order to obtain the Teaching Board approval. The project must contain the research activity's primary objectives, without describing details that may change during the development, and the courses chosen from the teaching plan (see below). The name of the tutor and the supervisor must be clearly indicated.

Safety duties

At the beginning of the PhD course, students must comply with the following duties regarding safety:

- Compulsory medical examination
- General training course on worker safety
- Specific training course on the safety of workers in experimental research laboratories
- Specific training course on safety during field activities

Schedule of planned training activities

The calendar of training activities planned for the 40th cycle of the SCGA Doctoral Course includes interdisciplinary courses, offered by the University Doctoral School, and specific intercurricular and curricular courses provided by the SCGA Doctoral Course. The teaching offer, uploaded on the eLearning platform, is specific for doctoral students and is provided in English. The teaching plan reflects the different cultural areas of the doctoral course and introduces also multidisciplinary, transdisciplinary and interdisciplinary elements, in line with the vision of the doctoral course published on the departmental website and on the first pages of this handbook. It is described during the welcome meeting held at the beginning of the first year. A detailed description of available courses can be found on the eLearning platform at the link: <https://elearning.unimib.it/course/index.php?categoryid=432>

Each PhD student must attend at least 100 hours of teaching for a total of at least 11 ECTS, of which at least 3 ECTS of interdisciplinary teaching provided by the University Doctoral School, and at least 8 ECTS of specific teaching provided by the SCGA Doctoral Course.

The 3 ECTS of interdisciplinary courses should be acquired by the end of the second year. The 8 ECTS of intercurricular and/or curricular courses provided by the SCGA Doctoral Course must be acquired within the end of the first year.

1) The interdisciplinary courses offered by the Doctoral School are aimed at providing, for example: linguistic-communicative and technological-computer skills; knowledge of the systems of financing, dissemination and valorization of research results; research ethics and business culture; Green skills. The interdisciplinary educational offer is presented to new doctoral students during the Welcome Day organized every year in November by the Doctoral School. The complete list of interdisciplinary courses can be consulted at the links:

<https://elearning.unimib.it/course/index.php?categoryid=6324>

<https://www.unimib.it/didattica/offerta-formativa/dottorato-ricerca/carriera/corsi-interdisciplinari/interdisciplinary-courses-class-schedules>

2) *The intercurricular and curricular specific courses offered by the SCGA Doctoral Course* allow doctoral students to build personalized educational paths. The intercurricular courses address, in a multidisciplinary perspective and of potential interest to doctoral students of the different curricula, topics such as climate change, environmental sustainability and advanced analytical techniques. The curricular teaching is instead aimed at specific topics within the different lines of research developed at the departmental level, even not strictly related to a specific doctoral project but anyway useful for the cultural and professional growth of the future PhD doctor. Each doctoral student must obtain, within the first year of the doctorate, at least 8 CFU of specific teaching. The intercurricular and curricular educational offer is presented to new SCGA doctoral students during the Welcome Meeting organized in November by the SCGA Teaching Board. The complete list of intercurricular and specific curricular courses offered by the SCGA PhD Course, and the dates of the lessons can be consulted at the links:

<https://elearning.unimib.it/course/index.php?categoryid=1732>

<https://www.disat.unimib.it/it/didattica/dottorato-scienze-chimiche-geologiche-e-ambientali/offerta-didattica>

https://drive.google.com/file/d/1UdHzshxKbdx6w9_OJ3KSj5RdFT-ufDij/view

Starting from November 2024, the management of the intercurricular and curricular teaching offer will take place through the GDA and Esse3 applications, similarly to the teaching offer of the bachelor's and master's degree courses. Each PhD student, after having agreed with his/her supervisor and tutor on the courses to follow to acquire the 8 CFUs of teaching provided by the SCGA doctoral course, will have to compile his/her own study plan by selecting the chosen courses following the instructions received from the doctoral school offices (dottorati@unimib.it). The courses required to obtain the 8 CFUs must be chosen from among the intercurricular ones and those provided within the curriculum one belongs to. The deadline for compiling the study plan is after the date of approval of the research project and the teaching to be carried out by the Teaching Board, thus allowing a considered and shared choice. At the end of each course, each PhD student will have to register for the exam registration (approved/not approved) following the instructions he/she will receive from dottorati@unimib.it.

Each PhD student may take advantage of the specific teaching offered by the SCGA PhD Course even in excess of the minimum 8 ECTS required. In this case, PhD students can also attend curricular courses belonging to other curricula. In addition, PhD students may attend, even in the years following the first year, seminars, workshops, summer schools and courses provided by other PhD courses or institutions. At the end of each course, it is good to have a certificate of attendance, indicating the course's duration (in hours), signed by the teacher, to be uploaded to the GoogleDrive folder assigned to each PhD student. These activities integrate the training activity for the amount exceeding the minimum threshold of 11 ECTS, and are reported by PhD students in their end-of-year report for the purposes of recognition by the Teaching Board.

It is recommended to keep the table of teaching activities updated, indicating the courses that you intend to follow, agreed with your supervisor, starting from the beginning of the doctoral course (see template at the link: <https://www.disat.unimib.it/it/didattica/dottorato-scienze-chimiche-geologiche-e-ambientali/documenti-utili>).

4) *PhD Day SCGA & MTM* (8 hours): Annual event organized by PhD students in collaboration with the Teaching Board. The PhD Day includes seminars with international speakers, oral presentations and a poster session curated by PhD students. The day is an important moment for presenting, comparing and exchanging the results of one's doctoral research with PhD students from other curricula and other scientific courses, as well as an important opportunity for PhD students to exercise their ability to independently organize and manage scientific sessions.

5) *Hands on RRI - Responsible Research and Innovation*. These are mandatory training days organized by the Doctoral School to guide PhD students, from the first to the third year, during all phases of their research up to the final phases of impact assessment and sharing of results. The program can be found at the link:

<https://www.unimib.it/didattica/offerta-formativa/dottorato-ricerca/carriera/corsi-interdisciplinari>

The RRI training days cover the minimum number of Public Engagement hours that the Ministerial Decree 226 requires PhD students to carry out annually.

The carrying out of additional Public Engagement activities is however encouraged by the Teaching Board. PhD students must inform their Coordinators about the Public Engagement activity carried out, and then report it in their end-of-year report and insert it in the Bicocca Open Archive (IRIS-BOA). The IRIS-BOA platform can be accessed via the link: <https://boa.unimib.it/>, where you can log in using your UniMiB credentials.

PUBLIC ENGAGEMENT ACTIVITIES

(The mandatory activity "*Hands on RRI - Responsible Research and Innovation*" covers the minimum number of Third Mission hours required by DM 226/2021. The carrying out of further public engagement activities is encouraged by the Teaching Board. PhD students must inform the Coordinator on the public engagement activity carried out, and report it in IRIS-BOA; note that the activity "*Non solo Ambiente ma Dialoghi di Scienza*" is reported in IRIS-BOA by the Coordinator)

| Year (1 st , 2 nd , 3 rd) | Description of the activity | Identificativo IRIS (e.g., PEN-0000) | Nr of hours |
|--|-----------------------------|---|----------------|
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Extracted from the template available on the departmental website

6) *Training period abroad*

Each PhD student must spend a period of at least 6 months abroad (12 months for co-tutorships with a double degree) upon authorization of the Teaching Board (the Coordinator must approve all the documents and forms at least 20 days before leaving). This is a period of joint research activity with other Universities or Institutions. In the absence of justified needs, the second year is the best period to spend the period abroad. During study periods abroad, provided that they last more than 30 consecutive days, the amount of the scholarship is increased by 50%. The PhD student must send every month (by e-mail) the certificate of attendance, signed by the foreigner tutor, to the appropriate office indicated on the form. You can find all related forms at the link: <https://www.unimib.it/didattica/offerta-formativa/dottorato-ricerca/carriera/modulistica-dottorandi>. The maximum permitted period of stay abroad is 12 months (18 months for co-tutorships aimed at obtaining the double degree of Doctor of Research, recognized in the two countries between which the co-tutorship agreement was stipulated). Carrying out co-tutorships is encouraged by the Teaching Board. The guidelines for activating a thesis co-supervision can be downloaded at the link: <https://www.unimib.it/didattica/offerta-formativa/dottorato-ricerca/carriera/studiare-alleestero>

Moments of exchange/presentation of the results of the PhD student research

The research activities carried out by the doctoral students are illustrated, on an annual basis, to the Teaching Board and the other doctoral students of the relevant curriculum, through an oral presentation which is preceded by the delivery to the members of the Teaching Board of an end-of-year written report of the activities carried out.

1) *End-of-year oral presentation*

The calendar of end-of-year presentations is defined well in advance and published on the departmental website. For the presentations of the first and second year, each doctoral student is guaranteed the presence of at least four auditors, including the supervisor, the tutor and two other experts in the field, who will be responsible for drafting written feedback regarding: (i) clarity and exhaustiveness of the report; (ii) effectiveness, clarity and completeness of the oral presentation and supporting material (slides); (iii) coherence and validity of the methodologies applied and the results obtained; (iv) suggestions on future directions. The written feedback is also integrated with any additional observations and suggestions from the members of the Teaching Board present during the presentation. The presentation, in English, lasts approximately 15 minutes with time for discussion.

Each presentation must be held by September 18 to allow the Teaching Board to decide on the admission to the next year in good time. The names of the experts and the date of the presentation are communicated by the supervisor to the Responsible of the curriculum (and in copy to the Coordinator) by June 30, together with the Webex link prepared by the supervisor to allow the widest possible participation to the oral presentation. This is a form of examination, which the Teaching Board evaluates to decide whether the doctoral student can move on to the next year, also based on the input provided by the supervisor. At the end of the presentation, the tutor sends written feedback to the Responsible of the curriculum, and in copy to the Coordinator and the Secretary. The feedback is embedded into the end-of-year report and then forwarded to the doctoral student.

The presentations of the third year, also in English, are preferably held in a single day for each curriculum. Written feedback from the audience is not foreseen to avoid overlaps with the tasks of the external evaluators. The presence of tutors, supervisors and PhD students is required.

2) *End-of-year reports:*

Each PhD student, approximately at the end of the academic year and before the end-of-year presentation, must write a report (in English) on his/her research activities. The report's structure is defined by the Doctoral School. It is also requested that an additional extended scientific report of the teaching and scientific activities carried out during the year is presented, in English, to the Teaching Board. This report integrates the report required by the Doctoral School, and it is drawn up according to the template available on the departmental website at the link:

<https://www.disat.unimib.it/it/didattica/dottorato-scienze-chimiche-geologiche-e-ambientali/documenti-utili>

The extended report must include the following information: (i) the ORCID of the PhD student; (ii) a summary of the scientific activity carried out within the framework of the research project; (iii) the list of all courses, seminars, etc. attended during the current year and in previous years; (iv) periods spent at institutions abroad; (v) any periods spent at other institutions or companies in Italy; (vi) the list of expenses incurred and reimbursed from the funds available to PhD students; (vii) any teaching or tutoring activities; (viii) Public engagement activities with the related IRIS-BOA links; (ix) the list of scientific publications and conference abstracts with the related IRIS-BOA links (<https://boa.unimib.it/>).

The access to IRIS-BOA is through login by insertion of academic username and password. A further control to login is represented by the “Google Authenticator”. The App is freely downloadable and generates a single-use number to be inserted upon request by the login system.

Once logged through Bicocca credentials and Authenticator number generated by the App, each user can insert into the personal page the “Products” (Desktop products) consisting in: 01-Articolo su rivista (Research article), 01b-Traduzione su rivista (Journal translation), 02-Intervento a convegno (Conference speech), 03-Contributo in libro (Book chapter/contribution), 03b-Traduzione in libro (Translation in book), 04-Monografia (Monography), 04b- Edizione critica – fonti inedite – commento scientifico (Critical edition – unpublished sources – scientific commentary), 04c-Traduzione di libro (Book translation), 05-Curatele (Curatorship), 06-Brevetti (Patents), 08-Tesi di specializzazione (Specialization thesis), 09-Tesi di dottorato (PhD thesis) and 99-Altro (Other). All the above voices must be filled where applicable for each PhD student and the personal IRIS-BOA page must be updated regularly.

The high number of positions managed by the SCGA PhD Course (35 PhD students enrolled in the 38th cycle, 32 in the 39th, and 15 in the 40th cycle), as well as the growing percentage of PhD students from abroad, guarantees the creation of an active community of PhD students. Every year, in October, PhD students exchange and present the results of their research during the SCGA & MTM PhD Day, an event organized by SCGA and MTM PhD students in collaboration with the Teaching Board. The event includes seminars with international speakers, oral presentations and a poster session curated by PhD students.

Interaction between PhD students at the Doctoral School level is guaranteed by courses dedicated annually to Responsible Research and Innovation, and by moments of discussion organized by the PhD students themselves, such as the event “Visions of the future: research, citizenship and sustainable development” <https://www.unimib.it/eventi/visioni-futuro-ricerca-cittadinanza-e-sviluppo-sostenibile>.

Other important moments of discussion and exchange are guaranteed by the wide range of summer schools offered by consortia of which the University of Milan-Bicocca is a member, such as the Lake Como School of Advanced Studies (<https://lakecomoschool.org/>) and the Venice International University (<https://www.univiu.org/>).

The Teaching Board encourages PhD students to participate in conferences and workshops as speakers and verifies that this occurs through monitoring the funds used for this purpose and by means of the end-of-year reports and presentations.

End of the PhD cycle. At the end of the PhD cycle, the following moments of presentation of the research results are planned, according to the calendar published on the Doctoral School website (see link: <https://en.unimib.it/education/postgraduates/doctoral-research-phd-programmes/during-your-phd/graduating>):

- *Submission of the thesis to be sent to external evaluators:* PhD students must upload their thesis online, written in English, which will be sent to two different external evaluators. Based on their observations, the evaluators may propose that the thesis be admitted to public discussion, or a 6-month postponement if they deem corrections and additions necessary. In the latter case, the modified thesis must be resubmitted to the evaluators.
- *Sending the thesis to the examiners:* Following acceptance by the evaluators, a copy of the thesis must be sent to each member of the final examination committee. The names of the members of the committee, approved by the Teaching Board, will be communicated by the Coordinator to all PhD students.
- *Final exam:* The final exam, in English, consists of a 45-minute presentation of the thesis, including a short report of the activities carried out during the entire PhD, followed by an in-depth discussion.

In general terms:

1st year

Most of didactic ECTS should be acquired
(including all the 8 ECTS provided by intercurricular and/or curricular courses, and at least part of the 3 ECTS of interdisciplinary courses)

2nd year

Training period abroad (at least 6 months)

3rd year

Writing of scientific articles and Thesis

Note that the PhD student status and the associated benefits expire at the end of the third year, even if the final exam has not yet taken place.

Resources available for PhD students to participate in conferences and/or workshops and/or training schools

Starting from the first year of the PhD, pursuant to Ministerial Decree 226/2021, each PhD student benefits from a budget for research activities equal to 10% of the PhD scholarship (1,624.30 euros/year for three years), the use of which is monitored by the Coordinator and reported annually by each PhD student in the end-of-year report. This budget is mainly intended for training activities such as participation in conferences, workshops and training schools. Further financial support is normally provided by supervisors: the submission of a call for interest for a potential PhD project in fact implies the availability of the supervisor, where required by the nature of the PhD project, to financially support the PhD student's research with funds at his/her disposal and in addition to the research budget provided for by Ministerial Decree 226/2021. The nature of these funds is explained in the calls for interest published on the departmental website together with the announcement.

Scientific research funds: Any student, either with or without scholarship, will be attributed 4872 euro as three slots of ca 1624 euro each year. This is the so-called additional budget of at least 10% for research activities envisaged by DM 226/2021. These funds can be in principle used for:

- Travel expenses (without kilometeric limitation)
- Accommodation costs (hotels up to the 2nd category – 3 stars)
- Refund for enrolment of meetings, courses or

Funds might also be used in principle for:

- Buying consumable materials, services, instruments maintenance, chemicals reagents, electronic components, lab animals, use of calculators etc.
- Refund for travel expenses (to be documented), if related to the thesis activities.
- Refund for open access license for publications as first authors related to the thesis.
- Refund for meetings enrolment if related to the thesis activities
- General costs: administration, telephone, mail, stationery

With these research funds it is not possible to:

- Invest (instruments, furniture etc.) in materials subject to inventory
- Buy books or journals
- Print any publication

Funds can be used either through the U-Web mission platform or through the Depot platform, which is unrelated to missions. Here are the links:

<https://unimib.u-web.cineca.it/appautmis/autorizza>

https://depot.unimib.it/depot_scienze/includes/user-management/

For insurance reasons, a mission must always be opened, through the U-Web mission portal, whenever one performs its activity outside the University of Milano-Bicocca, even for very short periods (hours or just a single day).

To use funding through the U-Web mission portal, students must indicate the Coordinator as responsible for funding, who will indicate the appropriate fund during the authorization phase of the mission. To use funding made available from the supervisor, students must indicate their supervisor as responsible for funding. Always choose “Type of request: MPR - Missione su progetti” and “Regolamento TES – Regolamento di Ateneo”.

To use funding through the Depot portal, students must send a request to the Coordinator to be associated with a specific fund. The Coordinator will forward the request to the CSS1 service center. The 50% increase in the scholarship, during a study period abroad that lasts more than 30 consecutive days, serves to cover the costs of food and accommodation during the stay, therefore it is not possible to request further reimbursements for this purpose. However, it is possible to request reimbursement of travel expenses to go to and return from the host institution abroad, or to cover expenses for participation in conferences etc. during that period.

Starting from November 2024, it is possible to use up to one full year of the budget (1624.30 euros) to contribute to the costs of accommodation and food abroad in addition to the 50% increase in the scholarship, compatible with the university regulations, but only for periods of stay of at least six consecutive months.

In exceptional cases, it is possible to request an advance on expenses (using your doctoral funds) to participate in particularly expensive conferences or to pay for tickets for particularly expensive flights (e.g. Australia, Maldives). However, keep in mind that this is an exception and not the norm. In all the other cases you will have to proceed with a normal mission, anticipating the expenses yourself and then receiving a refund later.

For airplane tickets: write to matilde.giberti@unimib.it (and the coordinator in cc) at least 2 months in advance in order to receive instructions (the CSS1 service center, which takes care of this type of order, requires ample advance notice to proceed).

In the case of conferences, it is possible to anticipate expenses almost exclusively for cumulative orders, therefore for more than one PhD student attending the same conference at a time (to consider proceeding for single doctoral students, the cost of registration must exceed 500 euros, and even in that case, it will depend on the CSS1 answer). PhD students must collect the names of all the participants and send a single email to matilde.giberti@unimib.it (and the coordinator in cc) at least 1.5 months before the registration deadline. The email must include the following data: (i) names of the participants; (ii) single registration fee; (iii) name of the conference, link to the conference page and to the registration costs; (iv) deadline for the registration; (v) name of the conference supplier and VAT number (plus payment data) to proceed with the payment by invoice (very important).

The use of scientific research funds (sensu DM 226) must be reported in the end-of-year report, see template at the link:

<https://www.disat.unimib.it/it/didattica/dottorato-scienze-chimiche-geologiche-e-ambientali/documenti-utili>

It is recommended that PhD students keep track of the expenses on these funds, and keep the table updated in order to answer any potential enquiries by the Coordinator.

Further financial support for analyses carried out by PhD students is normally provided by supervisors with funds at their disposal and in addition to the budget envisaged by Ministerial Decree 226/2021. The latter, although mainly intended for training activities such as participation in conferences, workshops and training schools, can also be used for the purchase of consumables, services, maintenance of instruments, chemical reagents, electronic components, use of computing platforms and for the reimbursement of documented travel expenses related to the PhD student's thesis activity.

PhD students have access to the University Central Library, which provides a collection of books covering scientific topics in the fields of chemistry, geology and the environment, and provides access to journals in the sectors covered by the PhD and to over 100 databases. PhD students also have access to clusters for parallel computing, significant software for the various sectors covered by the PhD (GIS, modeling, etc.), and software made available by the University such as Matlab, Mathematica and Stata. The University Central Library offers numerous services described at the link: <https://www.biblio.unimib.it/it> , including the remote access to resources (see <https://www.biblio.unimib.it/en/resources/remote-access-resources>)

PhD students have access to language courses, for example through the platform Rosetta Stone, an advanced language platform open to students at the University of Milano-Bicocca, offering online courses ranging from “beginner” (A1) to “expert” (C1) level: see <https://en.unimib.it/education/languages-unimib/rosetta-stone-language-courses>

The international connotation of the research activity is guaranteed by carrying out part of the activity at universities and research institutes abroad with the involvement of professors from foreign universities. To support the training and research period spent abroad, the grant is increased by 50% for periods spent abroad lasting more than 30 consecutive days.

To support co-tutelle doctoral courses, which allow training and research periods abroad for up to 18 months, starting from the 40th cycle, DISAT will contribute to covering any costs of enrollment of the doctoral student at the foreign university up to a maximum annual amount of 2,500 euros for each doctoral student.

Doctoral students are also actively supported in the procedures for requesting funds for Erasmus mobility.

Activities organized to develop the autonomy of the doctoral student in conceiving, designing, implementing and disseminating research and/or innovation programs

To ensure adequate support for the development of the autonomy of the doctoral student, each tutor follows on average no more than two doctoral students per year (six in total), up to a maximum of three (nine in total). The activities planned to develop the autonomy of the doctoral student in conceiving, designing, implementing and disseminating research and/or innovation programs include:

- (i) the annual reporting of the research activities carried out, teaching activities, tutoring, public engagement and the use of funds at their disposal in the end-of-year report;
- (ii) the organization of the PhD Day to exercise the ability to independently organize and manage scientific sessions;
- (iii) the activity “Not only Environment but Science Dialogues” to exercise the ability to present scientific topics to a non-expert audience, in a context that favors interdisciplinary discussion between doctoral students;

- (iv) the development of soft skills and transversal skills thanks to courses and workshops (e.g., Hands on RRI - Responsible Research and Innovation) that aim to provide PhD students with tools to deal with the entire research valorization chain, from responsible research to technology transfer, research entrepreneurship and public engagement;
- (v) the training and research period carried out abroad, which favors the construction of a network of relationships and interactions with other Universities and Research Institutions, increasing the international and multidisciplinary connotation of the training path and the possibilities of future employment in an international context.

Teaching and/or tutoring activities consistent with the research project allowed to each PhD student

It is expected that PhD students may carry out supplementary teaching activities, up to a limit of 40 hours per year, subject to authorization by the Teaching Board, which assesses whether the activity can be considered useful from an educational point of view and allows for adequate dedication to training and research activities. Teaching activities are not mandatory.

It is also expected that PhD students may carry out, subject to authorization by the Teaching Board, tutoring activities within the limits of consistency and compatibility with the research activities carried out, and for a maximum annual fee of 2,500 euros. Tutoring activities do not contribute towards reaching the 40-hour threshold. The Teaching Board encourages such activities and, in implementation of the University Tutoring Regulation (June 2023), coordinates with the Degree Courses to identify, for example, names of PhD students to propose for tutoring assignments to support degree thesis paths (for this purpose, calls are periodically made by the Teaching Board). The calls for tutoring issued by the University of Milano-Bicocca can be consulted at the link: <https://www.unimib.it/concorsi/collaborazioni-per-la-ricerca-e-di-supperto-alla-didattica/incarichi-di-tutorato>

Before undertaking any teaching activities, Ph.D. students submit an 'approval to teach' request to the Coordinator. The form can be found at the link: <https://www.unimib.it/didattica/offerta-formativa/dottorato-ricerca/carriera/modulistica-dottorandi>

Each teaching and/or tutoring activities should be reported in the end-of-year report.

SUPPLEMENTARY DIDACTIC ACTIVITIES TAUGHT BY THE PHD STUDENT

(optional activity, maximum 40 hours per year, subject to authorization from the Teaching Board)

| Year (1 st , 2 nd , 3 rd) | Academic year | Name of the course | Announcement code | Nr of hours |
|--|------------------|--------------------|----------------------|----------------|
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TUTORSHIP ACTIVITIES (optional activity, subject to authorization from the Teaching Board)

| Year (1 st , 2 nd , 3 rd) | Academic year | Type | Description of the activity | Announcement code | Nr of hours |
|--|------------------|------|-----------------------------|----------------------|----------------|
| | | | | | |
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Extracted from the template available on the departmental website

PhD students who wish to improve their teaching skills have free access to the teaching training seminars (Digital Clinic Webinars) available through the e-Learning platform at the link: <https://elearning.unimib.it/course/view.php?id=32977§ionid=258357>

Co-tutelle and/or the issuing of multiple qualifications

The SCGA Doctoral Course ensures doctoral students mobility periods consistent with the doctoral research project, in line with the objectives of the University Strategic Plan and the Departmental Three-Year Plan. The doctoral course activates on average at least one co-tutelle agreement aimed at issuing the double qualification for each doctoral cycle, also in substitution of the Doctor Europaeus qualification. The possibility of carrying out co-tutelle courses is promoted by the Teaching Board already in the phase of publishing the calls for interest. The co-tutelle courses are financially supported by DISAT, which contributes to covering any costs of enrollment of the doctoral student at the foreign university up to a maximum annual amount of 2500 euros for each doctoral student.

Type of research products expected for each PhD student

During the PhD program, each PhD student must publish the results of their research in peer-reviewed ISI journals. Starting from the 30th cycle, SCGA PhD students have published on average, one year after the end of the PhD program, at least two articles as first authors in indexed journals.

At university level, the intellectual property of each PhD student is protected. To ensure that the research products carried out by PhD students are directly attributable to the PhD students themselves and accessible in compliance with intellectual protection mechanisms, PhD students are required to obtain ORCID and upload all their research products to IRIS-BOA, such as scientific articles, abstracts of presentations at conferences, etc. The link to obtain your ORCID is: <https://orcid.org/>. In the IRIS-BOA platform (<https://boa.unimib.it/>), PhD students will find specific sections to upload their conference articles and abstracts (Prodotti) and their public engagement activities (Terza Missione).

The ORCID and IRIS-BOA codes must also be reported in the end-of-year report.

At the end of the PhD program (36 months), each PhD student must have submitted at least two manuscripts as first author to ISI journals. To access the final examination, each PhD student must have at least one article as first author in ISI journals, either in press, accepted or published. Remember to always include your ORCID to your publications.

Please carefully consider the possibility of publishing open access within the framework of the contracts stipulated by CRUI with the main publishers. For more information, see: <https://www.biblio.unimib.it/it/servizi/open-access-sconti-autori-it>

However, the budget available to PhD students provided for by Ministerial Decree 226/2021 can be also used to cover the costs of open access licenses relating to publications as first author dealing with the research carried out within the framework of the PhD project.

SCIENTIFIC PUBLICATIONS

(During the doctoral path, each doctoral student will have to publish the results of their research in peer-reviewed ISI journals. At the end of the doctoral course (36 months), each doctoral student must have submitted at least two first-name manuscripts to ISI journals. To access the final exam, each doctoral student must present at least one article in an ISI journal currently in print, accepted or published).

All research products must be uploaded into IRIS-BOA, even after the end of the doctoral path.

| Type of publication: e.g., Article, conference abstract, chapter in book etc. | List of Authors (Year) Title, Journal, Vol., Pages, DOI | Publication stage (published, accepted, under review) | Identificativo IRIS (e.g., hdi: 10281/474396) |
|--|--|---|--|
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Administrative deadlines and duties

All the forms necessary to fulfill deadlines and duties are available at:
<https://www.unimib.it/didattica/dottorato-ricerca/carriera/modulistica-dottorandi>
For info: dottorati@unimib.it

- **Enrolment renewal:** the enrolment renewal is fixed each year, generally, on September 30th. The procedure for the renewal can be found online for both scholarship holders and non-scholarship holders:
<https://www.unimib.it/didattica/offerta-formativa/dottorato-ricerca/carriera/tasse>
- **Payment of the II installment:** the deadline for the II installment payment (non-scholarship holders only) is usually around 16 May of each year. The amount due depends on the ISEE from a minimum of 0 euros to a maximum of 1.200 euro.
- **Final doctoral exam request:** the form must be sent to Segreteria online, usually during the first two or three weeks of October
<https://www.unimib.it/didattica/offerta-formativa/dottorato-ricerca/carriera/conseguimento-del-titolo>

Rights of the PhD students

- **Drop-out:** students who wish to drop out of the doctoral program must fill out and send the form to the Doctoral School Office one month before leaving. Students can drop out at any time. The doctoral scholarship will be paid up until the student leaves the program.
- **Suspension:** Ph.D. students may suspend their doctoral program in the following circumstances: maternity; a serious, documented illness; special situations; hiring under a temporary contract in the public administration during the trial period. The request to suspend the doctoral program must be sent to the Doctoral School Office at dottorati@unimib.it. If the student is a scholarship holder, the scholarship will be suspended until reintegration in the program. Students must make up for time lost because of the suspension before submitting the final doctoral exam request.
- **Extensions:** For proven reasons that do not allow the presentation of the doctoral thesis within the timeframes set by the duration of the course, the Teaching Board may grant, upon request of the doctoral student, an extension of a maximum duration of twelve months, without additional financial burdens. An extension of the duration of the doctoral course for a period not exceeding twelve months may also be decided by the Teaching Board for motivated and documented scientific needs, ensuring in this case the corresponding extension of the duration of the scholarship with funds from the University budget to be used for the doctorate.

For additional information, see:

https://www.unimib.it/sites/default/files/Dottori_di_ricerca/226_DR_modifica_regolamento_11marzo2022_P.pdf

- **Delegates:** any doctoral cycle (year) at the DISAT has the right/duty to elect a representative in the Department Council and in the Teaching Board of the Doctorate. PhD student delegates should collect any idea, question, and remark from other colleagues and bring them to the Council and the Teaching Board. Delegates can vote for all issues discussed in the Department council, except those of teachers' unique interest. PhD delegates are part of the Group for the Quality Assurance of the SCGA Doctoral Course. They are invited to periodic meetings with stakeholders (parti sociali) and lead the organization of the PhD Day activities.

- ***Departmental Car:*** any PhD student can use the Department car by handing in the appropriate requests. The use of the car can be booked at the link <https://prenotazioni.disat.unimib.it/>
- ***Reporting of critical issues:*** Both the Coordinator and the Responsible for the Quality Assurance are at the complete disposal of the PhD students to listen confidentially, even indirectly through the PhD students' representative, to those who show a low level of overall satisfaction.
- ***Psychological Counselling Service:*** This service is available to students who feel the need to focus on and clarify any personal issues. For information or to book an appointment: e-mail: counselling.psicologico@unimib.it

Prof. Marco G. Malusà

Coordinator of the PhD Course in Chemical,
Geological and Environmental Sciences

E-mail list:

| | | | |
|------|--------|----------------------|--------------------------------|
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Note that, starting from the second month of the PhD, communications will be sent exclusively to the institutional address.

Other email addresses used during the selection phase will be used in cc exclusively during the first month of the PhD.

List of interdisciplinary courses a.y. 2024-2025

Language and Communication Basic Skills

- Communicating research in the Era of social media
- Scientific writing in human and social sciences
- Writing of scientific papers
- Basic principles of public relations and media relations for academics
- Philosophy of Artificial Intelligence and robotics

Basic Technology Skills

- Introduction to statistics with R (part I): data description and basic inference
- Introduction to statistics with R (part II): linear and logistic regression models
- Productivity tools for (young) researchers
- Literature review: using the best searching tools
- Literature review: managing and evaluating your bibliography

Soft and Transferable Competences Within and Beyond Academia

- Design thinking and innovation planning
- The Appropriate Leadership. A sustainable approach to inclusive leadership in diverse contexts
- Giovani & Impresa
- Transferable competences and professional transitions

Research Management, Knowledge of Research System and Funding System

- International or foreign strategies, patent rights, employees and researchers' intellectual property rights
- Open Access publishing: a guide
- Surfing the academic job market: how to publish in high impact international journals
- Introduction to grant writing

Interdisciplinary Paths

- Freedom of research and public use of reason: developing critical thinking through four philosophical approaches
- Reading the world through gendered lens: a methodological reflection
- Scientific method: the fundamental concepts

Green Competencies

- Introduction to multidisciplinary aspects of sustainability
 - Cultural aspects of the climate crisis: meanings, denials and desires of environmental relatedness
 - Realising the Green Transition
 - Basic of biobased processes and biorefineries
 - The Concept of Sustainability through the lens of Historical Sciences
-
- ✓ The size of the class is limited: seats assigned on a first enrolled first served basis (enrollment through S3: <https://s3w.si.unimib.it>)
 - ✓ Interdisciplinary Courses are open to all PhD students, upon registration. When you read the syllabus, you find the number of places available. You must use the S3 system: you should register by entering the Segreteria On-line and choosing “Elective courses”, only during the registration periods specified for each course. The registration will be closed on the achievement of the maximum number of participants specified in syllabus. No additional registration on the e-learning platform is needed

For additional information, see:

<https://elearning.unimib.it/course/index.php?categoryid=6324>

<https://www.unimib.it/didattica/offerta-formativa/dottorato-ricerca/carriera/corsi-interdisciplinari/interdisciplinary-courses-class-schedules>

List of SCGA intercurricular and specific curricular courses a.y. 2024-2025 (see next pages)

Additional information can be found at the links:

<https://elearning.unimib.it/course/index.php?categoryid=1732>

<https://www.disat.unimib.it/it/didattica/dottorato-scienze-chimiche-geologiche-e-ambientali/offerta-didattica>

The dates of the lessons can be consulted at the links:

https://drive.google.com/file/d/1UdHzshxKbdx6w9_OJ3KSj5RdFT-ufDij/view

<https://elearning.unimib.it/course/index.php?categoryid=1732>

Teaching Plan 40°Cycle a.y. 2024/2025

| Course | Teacher(s) | SSD | hrs | credits | Educational form | Type of activity | Chosen/Mandatory |
|--|--|------------|------------|----------------|-------------------------------|-------------------------|-------------------------|
| Science: Observation and Prejudice | Eduardo Garzanti | GEO/02 | 8 | 1 | Lecture | Intercurricular | Chosen activity |
| Communication of Climate Change | Claudia Pasquero | GEO/12 | 8 | 1 | Lecture | Intercurricular | Chosen activity |
| The Climatic Role of Atmospheric Aerosol in the Arctic | Luca Ferrero | CHIM/12 | 8 | 1 | Lecture | Intercurricular | Chosen activity |
| Ice Core Science | Barbara Delmonte | GEO/04 | 8 | 1 | Lecture | Intercurricular | Chosen activity |
| Scanning and Transmission Electron Microscopy, Principles and Applications | Giancarlo Capitani, Paride Mantecca, Giovanni Maria Vanacore | GEO/06 | 28 | 3 | Lecture & laboratory training | Intercurricular | Chosen activity |
| Raman Spectroscopy: A Flexible Tool for an Integrated Research Approach | Sergio Andò, Maria Luce Frezzotti + didattica seminariale | GEO/02 | 16 | 2 | Lecture | Intercurricular | Chosen activity |
| Scanning Probe Microscopy: Principles, Applications, and Image Handling | Marcello Campione | FIS/01 | 12 | 1 | Laboratory training | Intercurricular | Chosen activity |
| Sustainable Chemical Processing Technologies | Heiko Lange, Luca Zoia | CHIM/06 | 16 | 2 | Lecture | Intercurricular | Chosen activity |

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|--|---|---------|----|---|-------------------------------|----------------------|-----------------|
| New Lignin-Based Sustainable Materials: Science and Technological Aspects | Luca Zoia, Ruggero Barni | CHIM/06 | 8 | 1 | Lecture | Intercurricular | Chosen activity |
| Critical Raw Materials and Their Environmental Impact | Alessandro Cavallo | GEO/09 | 16 | 2 | Lecture | Intercurricular | Chosen activity |
| Isotopes as Environmental Tracers | Barbara Leoni, Marco Rotiroti | BIO/07 | 20 | 2 | Lecture & laboratory training | Intercurricular | Chosen activity |
| Enhancement of Fragile Cultural Heritage | Ezio Bolzacchini, Chiara Rostagno, Luca Ferrero | CHIM/12 | 20 | 2 | Lecture & laboratory training | Intercurricular | Chosen activity |
| Machine Learning for Multivariate Data Analysis | Davide Ballabio | CHIM/01 | 20 | 2 | Lecture & laboratory training | Intercurricular | Chosen activity |
| Open-Source Software for Spatial Data Analysis | Micol Rossini | GEO/04 | 16 | 2 | Lecture | Intercurricular | Chosen activity |
| Spatial Variability of Environmental Characteristics and Mapping Methodologies | Chiara Ferrè | AGR/14 | 16 | 2 | Lecture | Intercurricular | Chosen activity |
| Time Series Analysis of Environmental Data | Tullia Bonomi + didattica seminariale | GEO/05 | 20 | 2 | Lecture & laboratory training | Intercurricular | Chosen activity |
| Carbon and noble gases systematics in the Earth's interior | Andrea Luca Rizzo | GEO/08 | 8 | 1 | Lecture | Intercurricular | Chosen activity |
| Advanced Techniques for Sample Preparation | Veronica Termopoli, Fabio Gosetti | CHIM/01 | 16 | 2 | Lecture | Chemistry Curricular | Chosen activity |

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|--|--|---------|----|---|-------------------------------|----------------------|-----------------|
| NMR spectroscopy applications to ligand-receptor studies | Cristina Airoidi | CHIM/06 | 20 | 2 | Lecture & laboratory training | Chemistry Curricular | Chosen activity |
| NMR spectroscopy of molecular Inorganic and Organometallic Compounds | Roberto Della Pergola | CHIM/03 | 8 | 1 | Lecture | Chemistry Curricular | Chosen activity |
| Advanced Theoretical Chemistry | Piercarlo Fantucci | CHIM/03 | 16 | 2 | Lecture | Chemistry Curricular | Chosen activity |
| Crystallography and Laboratory of X-ray powder diffraction | Chiara Ferrara, Riccardo Ruffo | CHIM/03 | 20 | 2 | Lecture & laboratory training | Chemistry Curricular | Chosen activity |
| Introduction to photochemistry | Luca Bertini, Claudio Greco, Antonio Papagni | CHIM/03 | 24 | 3 | Lecture | Chemistry Curricular | Chosen activity |
| Computational approaches for Structure-Based Drug Design | Stefano Motta | CHIM/02 | 16 | 2 | Lecture | Chemistry Curricular | Chosen activity |
| Detrital geochronology and thermochronology | Marco G. Malusà + didattica seminariale | GEO/02 | 16 | 2 | Lecture | Geology Curricular | Chosen activity |
| Provenance analysis: how to integrate single grain and bulk techniques | Sergio Andò, Alberto Resentini | GEO/02 | 16 | 2 | Lecture | Geology Curricular | Chosen activity |

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|--|---|---------|----|---|-------------------------------|--------------------|-----------------|
| Earth's volatile cycle: the fluid and melt inclusion approach | Maria Luce Frezzotti, Rosario Esposito, Andrea Luca Rizzo | GEO/07 | 24 | 3 | Lecture | Geology Curricular | Chosen activity |
| Monte Carlo Approach to Geophysical Inverse Problem: An Introduction | Nicola Piana Agostinetti | GEO/11 | 20 | 2 | Lecture & Laboratory training | Geology Curricular | Chosen activity |
| Advanced Field and Remote- Sensed Characterization of Rock Fractures in Outcrops | Federico Agliardi, Andrea Bistacchi | GEO/05 | 18 | 2 | Lecture & Laboratory training | Geology Curricular | Chosen activity |
| Introduction to geodynamic and landscape evolution numerical modeling | Pietro Sternai | GEO/03 | 20 | 2 | Lecture, computer work | Geology Curricular | Chosen activity |
| UAV/ROV and Immersive Virtual Reality for Research in Earth Sciences | Fabio Luca Bonali, Luca Fallati | GEO/03 | 18 | 2 | Lecture & Field activity | Geology Curricular | Chosen activity |
| Geoenergy and Geomechanics | Giovanni Battista Crosta, Riccardo Castellanza | GEO/05 | 16 | 2 | Lecture | Geology Curricular | Chosen activity |
| Advanced Experimental Testing and Monitoring on Geomaterials | Giovanni Battista Crosta, Riccardo Castellanza | ICAR/07 | 20 | 2 | Lecture & Laboratory training | Geology Curricular | Chosen activity |
| Geotechnical Modelling for Slope Stability and Underground Geostructures | Giovanni Battista Crosta, Riccardo Castellanza | ICAR/07 | 20 | 2 | Lecture & Laboratory training | Geology Curricular | Chosen activity |

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|---|---|--------|-----|----|-------------------------------|------------------------|-----------------|
| Native Plant Assemblages to Restore Degraded Lands | Sandra Citterio, Rodolfo Gentili | BIO/01 | 8 | 1 | Lecture | Environment Curricular | Chosen activity |
| Non-Animal Testing and Research: Ethical Issues and Scientific Applications | Chiara Urani | BIO/06 | 8 | 1 | Lecture | Environment Curricular | Chosen activity |
| Ecological Baseline and Conservation Paleobiology | Daniela Basso, Valentina Bracchi | GEO/01 | 16 | 2 | Lecture | Environment Curricular | Chosen activity |
| Next Generation Sequencing and Bioinformatic Tools for Ecological Studies | Andrea Franzetti, Isabella Gandolfi | BIO/19 | 20 | 2 | Lecture & Laboratory training | Environment Curricular | Chosen activity |
| Advanced Human Ecology | Emilio Padoa-Schioppa | BIO/07 | 16 | 2 | Lecture | Environment Curricular | Chosen activity |
| Ecosystem Services | Emilio Padoa-Schioppa + didattica seminariale | BIO/07 | 16 | 2 | Lecture | Environment Curricular | Chosen activity |
| Acoustics Applied to the Environment: Soundscape as Environmental Quality Index | Giovanni Zambon | FIS/07 | 12 | 1 | Laboratory training | Environment Curricular | Chosen activity |
| TOT. 41 | | | 652 | 74 | | | |