



Course unit English denomination	Chemometrics: Multivariate analysis
SS	CHEM-01/A
Teacher in charge (if defined)	Prof. Riccardo Leardi
Teaching Hours	30
Number of ECTS credits allocated	5
Course period	January 2026
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (75% minimum of presence) ☐ No
Course unit contents	This course introduces PhD students to the fundamental techniques of multivariate analysis, which are essential for studying relationships between observed variables and assessing similarity or dissimilarity between statistical units. Topics covered include principal component analysis, correspondence analysis, and cluster analysis, among others. Students will learn how to organize and display data effectively to extract meaningful patterns and insights. Theoretical concepts will be reinforced through hands-on exercises using real geological datasets. Data processing will be performed with CAT (Chemometric Agile Tool), an R-based software offering user-friendly tools for data visualization, preprocessing, and multivariate statistical analysis.
Learning goals	By the end of the course, students will have developed a strong understanding of multivariate analysis techniques and their applications in scientific research. They will acquire practical skills in handling and interpreting complex datasets, identifying patterns, and making data-driven decisions. Through hands-on exercises, they will gain proficiency in using statistical tools for multivariate analysis, with a focus on real-world geological data. Additionally, students will be able to critically assess the suitability of different multivariate techniques for various research questions, enhancing their ability to approach complex data challenges strategically and effectively.
Teaching methods	Teaching methods will include a combination of traditional lectures, aimed at providing direct instruction, and interactive sessions



designed to engage students in active learning. These methods will be supplemented by:

- Group work in class to encourage collaboration and peer support.
- Case studies and simulations to apply theoretical concepts to real-world scenarios.
- Interactive teaching techniques that promote active participation.
- Critical incident analysis to engage students in problem-solving.
- Constructive feedback practices to support continuous improvement.

This integrative approach is designed to promote a reflective, interactive learning experience while encouraging the development of both individual and collaborative skills.

Course on transversal, interdisciplinary, transdisciplinary skills

☒ Yes
☐ No

Available for PhD students from other courses

☒ Yes
☐ No

The course is open to everyone, with priority given to PhD students from the PhD Course in Geosciences. External PhD students who wish to enroll should send an email to dottorato.geoscienze@unipd.it and will be contacted if spots become available.

Prerequisites
(not mandatory)

Examination methods
(in applicable)

The PhD students are required to present a multivariate analysis case to the class.

Suggested readings

Slides prepared by the teacher plus specific material on the topic.

Additional information



Course unit English denomination	EBSD (electron backscatter diffraction)
SS	04/GEOS-01
Teacher in charge (if defined)	Prof. Richard Spiess
Teaching Hours	12
Number of ECTS credits allocated	2
Course period	November/December 2025
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (75% minimum of presence) ☐ No
Course unit contents	In this course, the main concepts and applications of Scanning Electron microscope (SEM) techniques are presented. The course introduces the PhD students to SEM techniques, with a particular attention to the electron backscatter diffraction (EBSD) technique. This course is of potential interest for those who are dealing with microstructures in the broadest field of the geological sciences. During the practical part of the course geological as well as artificial (e.g., anthropic manufacts, concrete, modern and old building) dataset will be analyzed. Laboratory exercises are designed to maximize the students' engagements. The course will be split in three parts: (1) a theoretical part that introduces students into the fundamental principles of EBSD (3 hours), (2) an applied part (6 hours) that shows how EBSD is used (in the SEM lab), and (3) a final discussion part (3 hours) dedicated to the analysis of the acquired data.
Learning goals	By the end of the course, students will have acquired a thorough and solid understanding of the fundamental principles of SEM techniques, with a particular focus on the EBSD technique, including key theories and practices relevant to scientific research. They will learn how to apply these techniques to analyze microstructures, particularly in geological and artificial materials. Students will gain hands-on experience in SEM lab settings, learning to acquire, process, and interpret EBSD data effectively. Additionally, they will develop the ability to critically analyze and apply EBSD techniques to various research contexts, including



	geological sciences and the study of anthropic materials, enabling them to integrate these techniques into their own research projects.
Teaching methods	Teaching methods will combine both theoretical instruction and practical, hands-on learning to ensure a comprehensive understanding of SEM and EBSD techniques. Additional teaching methods include: • Traditional lectures that provide the foundational principles of SEM techniques, with a focus on EBSD, ensuring students grasp the theoretical underpinnings of the methods. • Laboratory sessions in the SEM lab, where students will actively engage in acquiring and processing EBSD data from geological and artificial materials. These sessions will provide hands-on experience with the instruments and techniques. • Practical exercises designed to encourage critical thinking and application of the concepts learned, enabling students to work with real datasets and analyze materials from geological and anthropic contexts. • Group discussions and interactive feedback sessions, allowing students to share insights, ask questions, and collaboratively improve their data interpretation skills. • A final discussion session, where students will collectively analyze the acquired data, reinforcing their ability to process and interpret EBSD results in a variety of research settings. This integrative approach is designed to balance theoretical understanding with practical application, ensuring students gain both knowledge and hands-on skills in EBSD techniques.
Course on transversal, interdisciplinary, transdisciplinary skills	☒ Yes ☐ No
Available for PhD students from other courses	☒ Yes ☐ No The course is open to everyone, with priority given to PhD students from the PhD Course in Geosciences. External PhD students who wish to enroll should send an email to dottorato.geoscienze@unipd.it and will be contacted if spots become available.
Prerequisites	



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(not mandatory)

Examination
methods
(in applicable)

PhD students are required to discuss some of the obtained EBSD results.

Suggested readings

Slides and notes prepared by the teacher plus specific material on the topic.

Additional
information



Course unit English denomination	The PhD student in the research world: Part I - How to make a talk
SS	04/GEOS-02
Teacher in charge (if defined)	Prof. Giulio Di Toro
Teaching Hours	12
Number of ECTS credits allocated	2
Course period	May/June 2026
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (75% minimum of presence) ☐ No
Course unit contents	Part I: How to make a talk. This course focuses on developing the skills needed to deliver impactful presentations. Today people have limited time to make decisions. In an interview, one might have only few minutes to impact on someone, get a job and change her/his life. One has to prepare carefully her/his CV to be interviewed, but also the talk for the interview and think about the questions the people in the audience can make. Possible applications of short talks include: Job interviews; Viva of B.S., M.S., Ph.D. thesis, Scientific meetings, Professional reports.
Learning goals	By the end of the course, students will have acquired the knowledge and skills necessary to design and deliver clear and compelling presentations, tailored to a variety of professional and academic settings. They will learn strategies for organizing content effectively, engaging their audience, and handling challenging questions with confidence. Through practical exercises, students will refine their communication techniques, focusing on maximizing their impact in high-stakes situations such as job interviews, thesis defenses (B.S., M.S., Ph.D.), scientific meetings, and professional presentations. This course prepares students to craft well-structured talks, anticipate audience questions, and adapt their presentation style to different professional contexts.
Teaching methods	Teaching methods will include traditional lectures, providing direct instruction, along with interactive discussions and practical



exercises to apply the concepts learned. The course includes a mini-workshop where students will deliver their talks, which will be followed by constructive feedback from the instructor and peers. Additional teaching methods include:

- Group work to encourage collaboration and peer feedback on presentation techniques.
- Interactive discussions to explore effective communication strategies.
- Plenary sessions to analyze and discuss different presentation styles and audience engagement techniques.
- Constructive feedback sessions aimed at refining delivery and content organization.

This approach is designed to foster both individual improvement and collaborative learning, enabling students to refine their skills in delivering impactful presentations.

Course on transversal, interdisciplinary, transdisciplinary skills

☒ Yes

☐ No

Available for PhD students from other courses

☒ Yes

☐ No

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Prerequisites

(not mandatory)

Examination methods

(in applicable)

Candidates must give a talk on a research topic that will be commented and evaluated by the instructor and also reviewed by fellow PhD students in a peer-review process.

Suggested readings

Slides prepared by the teacher plus papers on the topic.

Additional information

Peer review by fellow PhD students involves completing a structured evaluation form with specific questions addressing key aspects of the presentation. These include whether the speaker effectively motivated the topic and engaged the audience, the quality and clarity of diagrams and figures, the appropriateness of font size and color, and the speaker's comfort, delivery style, and clarity.



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Course unit English denomination	The PhD student in the research world: Part II – How to construct a strong CV
SS	04/GEOS-01
Teacher in charge (if defined)	Prof. Martha Pamato
Teaching Hours	6
Number of ECTS credits allocated	1
Course period	June 2026
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (75 % minimum of presence) ☐ No
Course unit contents	Part II: How to construct a strong CV This course focuses on the meaning of some crucial “numbers” like the “H-index”, the “m-index”, the journal “impact factor”, the “citations”, the WoS and Scopus databases. Even if some of these parameters are not considered by all research institutes (see DORA Agreement), at the moment they still contribute to build up a CV, which could be evaluated at the international level. Although a CV cannot and must not be based only on these parameters, however, they are still a very critical issue in all national and international competitions. Finally, a very interesting program offered by our University is the so-called STARS, which is a very interesting funding program (at post-doctoral level) with the final aim to train a young researcher to apply for an ERC grant. In addition, the Italian Ministry of Education, Universities and Research carries out a national evaluation of Italian research every 5 years based on what is called “VQR” (Evaluation of the Research Quality), which is determined using some of the above parameters. At the same time, the “ANVUR” (National Agency for the Evaluation of Universities) every year allows researchers to apply to obtain the so-called “Abilitazione Scientifica Nazionale” (ASN), which officially provides the “habilitation” to Associate Professor or Full Professor and also in this case the habilitation is to some extent related to the above parameters.



	The course wants to face all these issues which are crucial for building an impacting CV to several research funding programs and to start an academic career in Italy or everywhere in the world.
Learning goals	By the end of this course, students will have a solid understanding of the key metrics used to evaluate academic CVs, such as the H-index, m-index, journal impact factors, and citation databases like WoS and Scopus. They will learn how these metrics impact career progression, grant applications, and academic evaluations both in Italy and internationally. Additionally, students will be equipped to construct a CV that not only highlights their achievements but also aligns with the evaluation criteria used in research funding programs and academic appointments. This knowledge will enable them to effectively navigate national and international academic systems.
Teaching methods	Teaching methods will include a variety of instructional strategies to ensure students gain a comprehensive understanding of how to construct a strong academic CV. The course will include: • Traditional lectures that provide foundational knowledge on key metrics such as the H-index, m-index, journal impact factors, and citation databases like WoS and Scopus. • Interactive discussions that foster critical thinking about the implications of these metrics in career progression and grant applications. • Hands-on activities where students will develop and refine their CVs, with guidance on aligning their accomplishments with evaluation criteria used in funding programs and academic appointments. • Case studies showcasing successful CVs and the strategic use of metrics in various academic contexts, particularly in Italy and internationally. • Peer review sessions that encourage collaborative feedback, allowing students to critique and improve each other's CVs. This multifaceted approach aims to empower students with the tools and knowledge necessary to navigate academic evaluations effectively and to create impactful CVs that enhance their competitiveness in research funding and career opportunities.
Course on transversal, interdisciplinary, transdisciplinary skills	☒ Yes ☐ No
Available for PhD students from other courses	☒ Yes ☐ No



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Prerequisites
(not mandatory)

Examination
methods
(if applicable)

Not applicable

Suggested readings

Slides provided by the teacher

Additional
information



Course unit English denomination	The PhD student in the research world: Part III - Research integrity and publication ethics
SS	04/GEOS-01
Teacher in charge (if defined)	Prof. Luca Valentini
Teaching Hours	6
Number of ECTS credits allocated	1
Course period	June 2026
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (75% minimum of presence) ☐ No
Course unit contents	The goal is providing young researchers with the necessary instruments to cope with the world of academic publishing. The course will first review the use and abuse of bibliometric indicators, then provide an overview of good and bad practices in scientific publishing. Specific subjects include: - Academic journals: how to be a good editor and reviewer. - Open access: opportunities and pitfalls. - Plagiarism: definitions and detection tools. - Detecting data and image manipulation. - Paper mills: detecting and handling suspected papers. - Citation cartels: establishing fair and virtuous collaborations. - Authorship and author contributions. - Use and misuse of AI. - Social responsibility in science.
Learning goals	It is expected that this course can help PhD students shift their focus from quantity to quality of their academic output. This course aims to raise awareness in the ethical aspects of scientific



	publishing. The teaching will provide a series of tools for the PhD students to find their way through the world of academic publishing, and understand the possible risks associated with bad publishing practice and academic misconduct. This course will also help distinguishing reputable journals from predatory ones, as well as trusted and reliable collaborators and coauthors. The attendees will develop decision-making skills to tackle and address potential ethical issues in complex research scenarios.
Teaching methods	The teacher will illustrate all concepts inherent in research integrity and publication ethics, providing definitions and presenting a series of case studies and potential scenarios. Examples of investigations from famous “science sleuths” will be illustrated. A series of specific tools and platforms (e.g. PubPeer, Google Images, AI-assisted detection tools) will be illustrated and the students will be able to practice in dedicated hands-on sessions. Class discussion on the addressed topics and students feedback will be encouraged. Learning assessment will be carried out using student response platforms. This multifaceted approach to learning will maximize the active involvement of the attendees into a complex topic such as publication ethics.
Course on transversal, interdisciplinary, transdisciplinary skills	☒ Yes ☐ No
Available for PhD students from other courses	☒ Yes ☐ No The course is open to everyone, with priority given to PhD students from the PhD Course in Geosciences. External PhD students who wish to enrol should send an email to dottorato.geoscienze@unipd.it and will be contacted if spots become available.
Prerequisites (not mandatory)	
Examination methods (if applicable)	
Suggested readings	Slides, papers and websites provided by the teacher.
Additional information	



Course unit English denomination	ABC Bibliographic Research in Geosciences
SS	Not applicable
Teacher in charge (if defined)	Dr. Matteo Cefis
Teaching Hours	10
Number of ECTS credits allocated	1.7
Course period	January 2026
Course delivery method	☒ In presence ☐ Remotely ☒ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (75% minimum of presence) ☐ No
Course unit contents	This course, offered by the librarians of the Department of Geosciences, is designed to equip PhD students with essential skills for conducting bibliographic research. The course introduces effective techniques for searching, finding, and utilizing academic resources relevant to geosciences. Students will complete an online module on bibliographic search methods, participate in practical in-person sessions within the library to reinforce search techniques, and attend a workshop focused on using Zotero for managing bibliographies and aiding in the thesis-writing process. This compulsory course requires at least 75% attendance, and upon completion, students will receive a certificate of participation.
Learning goals	By the end of this course, students will have developed essential skills in bibliographic research specifically tailored to geosciences. They will be able to efficiently search, locate, and utilize bibliographic resources relevant to their research and thesis work. Additionally, they will gain proficiency in using key tools for organizing and managing bibliographic information, enabling them to keep a well-organized repository of research sources. This knowledge will help them conduct thorough literature reviews and improve the depth and rigor of their academic writing.
Teaching methods	Teaching methods for this course will combine online, in-person, and practical sessions, covering both theory and application:



- Theoretical component: An online module on bibliographic research accessible through Moodle, where students will learn foundational concepts and strategies for conducting effective bibliographic searches.
- Practical in-person session: Hands-on exercises held in the department's library, where students will apply search techniques with the guidance of librarians and practice locating resources relevant to geosciences.
- Workshop on Zotero: A focused session on using Zotero, a tool for managing bibliographies and streamlining the thesis-writing process, ensuring students can organize and cite their sources effectively.

This mixed approach supports a solid understanding of bibliographic research skills and practical familiarity with the tools needed for effective academic writing and research.

Course on transversal, interdisciplinary, transdisciplinary skills

☒ Yes

☐ No

Available for PhD students from other courses

☒ Yes

☐ No

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Prerequisites

(not mandatory)

Examination methods

(if applicable)

Suggested readings

Additional information

At the end of the course, participants will be given a satisfaction questionnaire and each PhD student will receive a certificate of participation.