



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
