Main course information	
Academic subject	Environmental Mineralogy
Degree course	Science of Nature and Environment
Degree class	Master degree
ECTS credits (CFU)	8
Attendance policy	According to curriculum didactic regulation
Teaching language	Italian
Accademic Year	2019/2020

Professor/Lecturer	
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Tutorial time/day	Tuesday and Friday h: 11-13 at Dept. of Earth and Geoenviromental Sciences

Course details	Study area	SSD code	Type of class
		GEO/06	Lecture/workshop

Teaching schedule	Year	Semester
	2nd	1st

Academic credits of the course	CFU/ECTS	Lessons (hours)	CFU/ECTS lab	Lab hours	CFU/ECTS tutorial/workshop	Tutorial/workshop hours	CFU/ECTS field trip	Field trip Hours
	7	56	1	20				

Teaching activities	Total hours	Teaching hours	Self-study hours
	200	76	124

Academic Calendar	First lesson	Final lesson
	According to curriculum didactic regulation	According to curriculum didactic regulation

Syllabus	
Course entry requirements	Chemistry, Physics and Mineralogy at basic level.
Expected learning outcomes (according to Dublin Descriptors) (it is recommended that they are congruent with the learning outcomes contained in A4a, A4b, A4c tables of the SUA-CdS)	
Knowledge and understanding	Practical and theoretical knowledge of minerals and synthetic analogues which have any impact on the environment and human health. Knowing the investigations required by the current legislation and also the approaches especially suited for a correct characterisation and identification of a particular environmental issue;
Applying knowledge and understanding	At the end of this course any student will be able to: - recognize, by means of proper investigations, different (variouses) minerals harmful to environment and human health: - plan more adequate investigations to identify environmental issues.
Making informed judgements and choices	At the end of this course any student will be able to express autonomously own opinion: - about the mineralogical methods more suited to identify and assess the pollution caused by mineral species and plan possible strategies foe remediation. - about the quality of collected data and the correctness and processing performed on them.
Communicating knowledge and understanding	ability to express and disseminate own knowledge with proper scientific-technical language; Presentation of the results obtained by chemical/physical and mineralogical

	analysis ability to integrate swiftly and efficiently in work places and scientific laboratories coordinate with different professional profiles in the remediation and analytical field.
Capacities to continue learning	At the end of this course any student will gain abilityof critical evaluation about proper investigations to identify pollutant minerals, distinguishing between minerals suited to remediation and unregulated compounds.

Syllabus	
Course content	Mineral recognition by means of physical features: specific gravity; hardness; toughness. Breaks and cleavage; electrical properties; Piezoelectricity; magnetic properties; The origins of color in minerals. Methods of mineral investigation: X-ray powder diffraction (XRPD) for phase analysis: sample loading, powder diffractogram collection , data processing. X-ray fluorescence (XRF) in energy or wavelength dispersive mode for chemical analysis of minerals and/or rocks. Scanning electron microscope used to identify and measure the abundance of elements in samples of environmental interest. Thermoanalytical methods: thermogravimetric analysis (TGA) and differential thermal analysis (DTA). Raman Spectroscopy. Basic principle of Raman effect. Raman spectrum interpretation. Enviromental applications of Raman spectroscopy. Envriromental issues: Radioactivity. Metamitic minerals. Radioactive waste management. Asbestos minerals: Classification of asbestos minerals, their structure and chemical composition. Health hazard in the industrial processing and enviroment. Monitoring, control measures and managment of asbestos-containing materials. Remediation examples. Particulate matter: definition and enviromental examples. Mineral role in sequestration and release of toxic elements. Zeolites: structure and crystal- chemical features. Applications of natural and synthetic zeolites in agricolture, industrial processing, zootechnik and environmental issues. Soil minerals and reaction mechanism in soil. Biominerals. Bioremediation. Phytoremediation.
Reference books/Bibliography	Putnis, A.: Introduction to mineral sciences C. Klein – Mineralogia – Ed. Zanichelli
Notes	selected chapters – the reference books are available to everybody for consultation at the Library of the Department of Earth and Geoenvironmental Sciences – Slides and lecture notes are also provided.
Teaching methods	Lectures with visual help of slides. Individual and collective laboratory experience.
Assessment methods (indicate at least the type written, oral, other)	Oral exam covering questions regarding on the different parts held in class, about exercises and laboratory activity.
Evaluation criteria (Explain for each expected learning outcome what a student has to know, or is able to do, and how many levels of achievement there are	In the evaluation of the oral exam the determination of the final grade will take into account the following elements: 1) the acquired level of knowledge of the topics covered during the course (insufficient, superficial, good, complete, excellent). 2) correct use of scientific terminology (insufficient, superficial, good, complete, excellent) 3) the ability to use proper analytical approach (insufficient, discrete, good, excellent); 4) the capacity for critical analysis and judgment autonomy of data

	interpretation (insufficient, discrete, good, excellent); The active participation of students in lectures and laboratory exercises, will also be evaluated in a positive sense.
Further information	