



SYLLABUS

A. Course Description

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab.	Tut.	Private study	Pre-requisites	Course Level	Language
CHM	434	Environmental Chemistry	3	2	2	0	6	CHM 333	7	English

This course describes fundamentals of environmental chemistry, atmosphere, hydrosphere, lithosphere, ozone, environmental pollution and its sources. The course covers essential topics in environmental chemistry where concepts such as toxicological chemistry, ecology, industrial pollution, acid rains, smog and analytical methods of environmental toxins will be taught. The practical part consists of a set of experiments that reinforce the module concepts. At the end of this course the student will be able to

- Understand the basics of environmental chemistry and its impact on the biosphere.
- Develop awareness of the impact of environmental problems and ways to reduce them.
- Know the fundamental chemical processes that are central to important environmental problems.
- Utilize this knowledge in making critical evaluations of these problems.
- Carry out experiments to determine the moisture contents, alkalinity and acidity of soil.

B. References: Required Textbook & Internal Website

I shall use

Environmental Chemistry, Stanley A. Manahan, (7th Ed.), Boca Raton: CRC Press LLC, 2000, ISBN: 978-1-4398-3276-9.

Students are required to purchase the textbook/materials (it is an obligation). The book contains the lecture notes as well as activities for the students to take part in; the book serves as a workbook. Other references:

- *Elements of environmental chemistry*, Ronald A. Hites and Jonathan R. Raff (2nd Ed.), John Wiley & sons, Inc. New York, 2012, ISBN 978-0-471-99815-0 ISBN 978-0-471-99815-0.
- *Environmental soil and water chemistry, Principles and Applications* V. P. Evangelou, (1st Ed), John Wiley & Sons, Inc. New York. ISBN: 978-0-471-16515-6

Google Classroom Webpage: <http://www.imamm.org/>

C. Topics Outline

Disclaimer: this is a very fast-paced course. There will be little time—if any—for review. What follows is an approximate outline of the pace of the course. We may go faster or slower, contingent on the class response. The tentative list of topics to cover:

a. Theory:

1. Environmental Chemistry of water:

Definition of the environment and its components - general introduction to environmental chemistry - properties and sources of water - aquatic chemistry - nitrogen oxides in atmosphere - metal ions and calcium- oxidation reduction - complexation and chelation.



2. Water pollution: Nature and types of water pollutants - elemental pollutants - heavy metals - metalloids - organic and inorganic species - acidity, alkalinity and salinity - oxygen, oxidants and reductants - pesticides, polychlorinated biphenyls and radionuclides in aquatic environment.

3. Water treatment: Water treatment and water use - municipal water treatment - treatment of water for industrial use - sewage water - industrial water treatment - removal of solids - removal of calcium and other metals - removal of dissolved organics and inorganics - sludge - water disinfection - water reuse and recycling.

4. The atmosphere and atmospheric chemistry: Atmosphere - chemistry of atmosphere - importance of atmosphere - physical characteristics of atmosphere - inversions and air pollution - chemical and photochemical reactions in the atmosphere - acid base reaction in the atmosphere - reactions of atmospheric oxygen - reactions of atmospheric nitrogen.

5. Inorganic air pollutants

Carbon dioxide - sulfur dioxide sources and sulfur cycle - nitrogen oxides in atmosphere - acid rain - fluorine chlorine and their gaseous compounds.

6. Organic air pollutants and photochemical smog: Pollutant hydrocarbons - photochemical smog - smog-forming automotive emission - smog-forming reactions of organic compounds in the atmosphere - mechanism of smog formation.

7. Soil environmental chemistry: Nature and composition of soil - acid-base and ion exchange reactions in soils - nitrogen, phosphorus and potassium in soils - fertilizers - waste and pollutants in soil - preparation of waste for disposal.

8. Toxicological chemistry: Introduction to toxicology and toxicological chemistry - dose-response relationship - toxic elements and elemental forms - toxic inorganic compounds - toxicological chemistry of organic compounds - application of nanomaterials for toxins removal from water - The impact of environmental pollution on human health.

9. Industrial Ecology, Resource and Energy: Metal resource and ecology - world energy resource - energy conservation - petroleum, coal and natural gas - nuclear fission and fusion - the sun energy and energy from biomass.

10. Environmental analysis: Introduction of environmental chemical analysis - analysis of water samples - classical methods of water analysis - instrumental methods of water analysis - analysis of waste and solids - atmospheric monitoring - environmental hazards assessment.

b. Practical:

Alkalinity of streams and lakes, determination of trace levels of ions in natural waters, conductivity of various waters, determination of the hardness of natural waters, determining iron and manganese in natural waters and sediments, COD, BOD, kinetics of pollutants degradation.

D. Exams & Grading System

The semi-official dates of the exams for this course, with all the caveats, that the word “semi-official” entails, can be found here:

- **Midterm 1:** 6th or 7th week & **Midterm 2:** 11th or 12th week
- **Quizzes & Homeworks:** During the semester



Your course grade will be based on Final Exam, Midterms, Homework, Quizzes, Participation, Attendance and Project.

Midterm 1: 10 %	Midterm 2: 10 %	Final Exam: 40 %
Laboratory: 30 %	Quizzes; Homework & Attendance & Participation: 10 %	

Grading distribution:

A+: [95, 100], A:[90, 95), B+: [85, 90) , B: [80, 85), C+: [75, 80), C: [70, 75), D+: [65, 70), D: [60, 65), F: [0, 60).

E. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

[Executive Rules for Study Regulations and Examsgoo.gl/ykm7t3](https://Examsgoo.gl/ykm7t3)

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