
AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF HEALTH SCIENCES
Department of Environmental Health
Fall 2023-24

ENHL232 (3 cr.): Instrumentation, Analytical Techniques, and Sampling

Course Instructor: *Dr. May Massoud*

Office: Van Dyck, room 415

Office Hours: Zoom/WebEx or in person. To set a meeting by appointment (please e-mail at mm35@aub.edu.lb)

Tel. Ext.: 4628; E-mail: mm35@aub.edu.lb

Location and Time: Van Dyck, room 101; Tuesday and Thursday: 08:00 - 9:15 am

Lab: Wednesday: 1:00 - 3:00 pm

COURSE DESCRIPTION

ENHL 232 (3 crs.): The course introduces the basic concepts and applications of different sampling methods, and instrumental and analytical techniques: electrical conductance, absorption spectrophotometer (visible, ultraviolet light, infrared, atomic absorption), emission (flame photometry) and chromatography (gas chromatography and high performance liquid chromatography).

In this course students will participate in the design of a field study and explore the process of conducting environmental assessment, from sample collection to report writing. Detection and quantification techniques commonly used in environmental analysis and the integration of quality control procedures will be discussed.

LEARNING OUTCOMES

- LO1. Understand the basic principles for planning and implementing an environmental sampling program.
- LO2. Determine sampling needs, sample quantities, frequency of sample collection and the factors that affect the suitability of sampling sites.
- LO3. Explain the methods for the collection and handling of water, sediment, soil and air samples.
- LO4. Comprehend the operational theory that is required to safely and effectively operate a number of analytical instruments for measuring environmental chemical contaminants.
- LO5. Identify which instruments are suitable for which types of analyses.
- LO6. Develop the skills/knowledge to perform analytical tests and analyses.
- LO7. Evaluate the reliability of analytical data using quality control techniques.
- LO8. Prepare a written field environmental assessment report describing the methods, quality control/quality assurance program and results.

COURSE RESOURCES

There is no required textbook for this course. Lecture handouts will be available on the **course Moodle**.

Reference Books/Documents

Popek, E. 2018. Sampling and Analysis of Environmental Chemical Pollutants: A Complete Guide (2nd ed.). Elsevier.

Conklin, A. 2017. Field Sampling: Principles and Practices in Environmental Analysis. CRC Press.

Articles

Massoud, M.A. (2012). Assessment of Water Quality in the Damour River Basin in Lebanon Using the Water Quality Index. *Environmental Monitoring and Assessment* 184(7), pp. 4151-4160.

Massoud, M.A., El-Fadel, M., Scrimshaw, M.D. and Lester, J.N. (2006). Factors influencing development of management strategies for the Abou Ali River in Lebanon I: Spatial Variation and Land Use. *Science of the Total Environment* 362, pp. 15-30.

You might want to check out scholarly journals for current information. Access to some journals can be attained electronically. ([AUB Homepage](#), [Libraries](#), [Jafet](#), [Engineering and Science](#), [Current Journals](#), [Select a Discipline](#), [Environmental Science](#))

ASSESSMENT OF STUDENT PERFORMANCE

Table 1. Assessment methods mapped to course Learning Objectives

Mode of Assessment of Students	Learning Objectives							
	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8
Sampling Protocol (5%)	X	X	X					
Assignments (10%)	X	X		X	X			
Midterm Exam (30%)	X	X	X	X				
Final Assessment Report (15%)				X			X	X
Final Exam (30%)	X	X	X	X	X		X	
Lab Work + Participation + Attendance (10%)						X		

Exams may include multiple choice, true/false, short answer questions, problems and/or case studies. Calculators are allowed during examinations, but sharing calculators is not allowed.

COURSE POLICIES

Attendance

Attendance in this course follows University regulations. For more information, kindly refer to AUB Catalogue.

Class participation

Learning is an interactive process. Participation in class whether by asking questions when you don't understand or by giving your opinion when it is appropriate is essential for learning.

Team work

Working in a team is of great importance among multidisciplinary professionals. It requires communication and interpersonal skills, good coordination and project management. You should always do your share in partner or group work.

Assignments

You are expected to submit assignments on time. Late assignments will be penalized by a reduction in grade and should be submitted the following session. You should have a valid reason as determined by the instructor for not submitting the assignment on time.

Exams

You are expected to take exams on scheduled time. Failure to take a scheduled exam will result in a zero. Make-up exams may be given to students who provide a valid reason and supporting documentation as determined by the instructor. The instructor reserves the right to change the format and increase the level of difficulty on any make-up exam. Make-up exams must be scheduled within one week of the original examination date.

Withdrawal

The last day for a student to withdraw from this course is **Friday Nov. 17, 2023**. Any student with an average grade below 60, by that date, is recommended to consult with his/her academic advisor and may consider withdrawing from the course.

Code of Conduct

Education is demanding and time management is essential. Do not hesitate to use the resources around you but do not cut corners. Cheating and plagiarism will not be tolerated. Please review the Student Code of Conduct in your handbook and familiarize yourself with definitions and penalties (AUB home page, www.aub.edu.lb; policies and procedures; Student Handbook). If you're in doubt about what constitutes plagiarism, ask your instructor because it is your responsibility to know. The American University of Beirut has a strict anti-cheating and anti-plagiarism policy. Penalties include failing marks on the assignment in question, suspension or expulsion from University and a permanent mention of the disciplinary action in the student's records.

Class Conduct

Be Punctual: Class will start on scheduled time. If you must arrive late or leave early, let me know in advance.

Kindly avoid activities that are disruptive to the learning environment in the classroom. You are expected to be respectful of other peers and the instructor at all times. Appropriate measures will be taken against disrespectful students in due time.

For more information please review all rules and regulations set forth in the current edition of the Student Code of Conduct (AUB home page, www.aub.edu.lb; policies and procedures; Student Handbook).

Communication via email

Announcements will be made in lectures as required. I will be sending all communication via Moodle to your AUB email accounts. All students should check their AUB email on a regular basis, as this is a primary means of communication for the course. You are responsible for any missed information in class or via email.

Course Evaluation

At the end of the semester you will be asked to fill a course evaluation form. Your objective opinion is highly solicited to get accurate data.

Students' Comments about Course Policies and Procedures

I welcome and encourage students' comments concerning any aspect of this course. It is recommended to submit your comments first in writing and discuss them with me outside of class time.

STUDENTS WITH SPECIAL NEEDS

AUB strives to make learning experiences as accessible as possible. If you anticipate or experience academic barriers due to a disability (including mental health, chronic or temporary medical conditions), please inform me immediately so that we can privately discuss options. In order to help establish reasonable accommodations and facilitate a smooth accommodations process, you are encouraged to contact the Accessible Education Office: accessibility@aub.edu.lb; +961-1-350000, x3246; West Hall, 314.

NON-DISCRIMINATION AND ANTI-DISCRIMINATORY HARASSMENT, INCLUDING SEXUAL HARASSMENT AT AUB

In line with its commitment to the principle of equal opportunity in education and employment, AUB policies protect you from discrimination on the basis of protected characteristics, including discriminatory harassment and sexual harassment. Protected characteristics include: race, color, religion, age, national or ethnic identity, sex, gender or gender identity, sexual orientation, pregnancy, marital status, disability, genetic predisposition or carrier status, alienage or citizenship status, and political affiliation.

The policies are applicable to all the AUB Community including: officers, faculty, staff, academic appointees, students (including medical interns and residents), visiting students, alumni, trainees, visitors, contractors, subcontractors, suppliers, located on campus and at AUB Medical Center, Advancing Research Enabling Communities Center (AREC), or any other facility or program affiliated with the University. The "AUB community" also includes the dependents and domestic employees of faculty and staff dwelling on campus and at AREC.

If you think you have experienced discrimination, discriminatory harassment, or sexual harassment, we encourage you to inform the Equity/Title IX Coordinator, Mitra Tauk at 01-350000 ext. 2514, titleix@aub.edu.lb, report to a Title IX deputy at your faculty or at any other faculty (www.aub.edu.lb/titleix), or report online (www.aub.ethicspoint.com). Reports may be submitted anonymously or not. Please know that the University will maintain the confidentiality of the complaint and privacy of the persons involved to the greatest extent possible, consistent with its goal of conducting a thorough and complete investigation and to the extent permitted by law.

You need to also know that the University has designated academic and administrative department/unit heads, managerial level staff, academic advisors, protection officers, and residence hall staff/monitors, as responsible employees or "mandatory reporters", and may designate others at its discretion. These individuals are obligated to report actual or suspected discrimination or discriminatory harassing conduct to the Equity/Title IX Coordinator, unless they are a "confidential" resource. The following have been designated as confidential resources: on campus counselors in the Counseling Center of the Office of Student Affairs and AUB Medical Center counselors, and healthcare providers at the University Health Services (UHS) and at the AUB Medical Center. Confidential resources are not required to report actual or suspected discrimination or harassment to appropriate university officials, except in cases of suspected abuse of a minor, in the event of an external investigation or prosecution, or in the event of imminent danger to the reporting party or others.

COURSE PLAN*

Date	Topic/Assignment
Aug. 29	Course content and requirements
Aug. 31	Introduction: concentration units; interpretation of data (precision and accuracy); dilution calculations
Sept. 05	Overview of the analytical process Classification, selection criteria, and components of analytical methods
Sept. 07	Overview of sampling and analysis Types of environmental samples; sampling approaches; selection criteria of appropriate sampling devices; handling and storage of samples
Sept. 12	Specific sampling techniques for different media
Sept. 14	Design of sampling protocols Quality Assurance/Quality Control Considerations
Sept. 19	Electrochemistry; oxidation-reduction reactions
Sept. 21	Electrochemical methods and instruments (theory and analytical use)
Sept. 23	Field Trip
Sept. 26	Problem solving session
Sept. 28	Radiant energy and matter: Introduction
Oct. 03	Problem Solving Session
Oct. 04	Lab Session
Oct. 05	Spectroscopic methods: Principles of spectrochemical analysis
Oct. 10	Components and instrumental design of spectroscopic instruments
Oct. 11	Lab Session
Oct. 12	Problem Solving Session
Oct. 17	Theory and application of UV/Visible spectrophotometer Theory and application of IR and NMR spectrophotometer
Oct. 19	Theory and application of atomic absorption spectrophotometer
Oct. 24	Theory and application of atomic absorption spectrophotometer (Cont'd)
Oct. 25	Lab Session
Oct. 26	Assignment I Discussion Theory and application of atomic emission spectrophotometer
Oct. 31	Exam I
Nov. 02	Exam Correction
Nov. 07	Assignment II discussion Classification and principles of separation/chromatographic methods

* The following is a general outline of material to be covered during the semester.

Note: the schedule is subject to changes in response to progress and opportunities that may arise in a given semester. Any changes to the schedule will be announced in class.

Nov. 19	Theory and application of gas chromatography
Nov. 14	Theory and application of gas chromatography (Cont'd)
Nov. 16	Theory and application of high performance liquid chromatography
Nov. 21	Demonstration Session (LEAF)
Nov. 23	<i>Assessment Report Correction</i>
Nov. 28	<i>Revision</i>
TBA	Final Exam

Enjoy the course!