

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

Course Instructor: *Dr. May Massoud*

Office: Van Dyck, room 415

Office Hours: Tuesday and Thursday: 8:30 – 9:30 am and 12:30-1:30 pm or by appointment

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Location and Time: Van Dyck, room 101; Tuesday and Thursday: 11:00 - 12:15 am

Lab: Monday and 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			
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 **Thursday Nov. 21, 2019**. 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 – Title IX – AUB

AUB is committed to facilitating a campus free of all forms of discrimination including sex/gender-based harassment prohibited by Title IX. The University's non-discrimination policy applies to, and protects, all students, faculty, and staff. If you think you have experienced discrimination or harassment, including sexual misconduct, we encourage you to tell someone promptly. If you speak to a faculty or staff member about an issue such as harassment, sexual violence, or discrimination, the information will be kept as private as possible, however, faculty and designated staff are required to bring it to the attention of the University's Title IX Coordinator. Faculty can refer you to fully confidential resources, and you can find information and contacts at www.aub.edu.lb/titleix. To report an incident, contact the University's Title IX Coordinator Trudi Hodges at 01-350000 ext. 2514, or titleix@aub.edu.lb. An anonymous report may be submitted online via EthicsPoint at www.aub.ethicspoint.com.

COURSE PLAN*

Date	Topic/Assignment
Aug. 29	Course content and requirements
Sept. 03	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. 12	Overview of sampling and analysis Types of environmental samples; sampling approaches; selection criteria of

* 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.

	appropriate sampling devices; handling and storage of samples
Sept. 17	Specific sampling techniques for different media
Sept. 19	Design of sampling protocols Quality Assurance/Quality Control Considerations
Sept. 21	Field Trip
Sept. 24	Electrochemistry; oxidation-reduction reactions
Sept. 26	Electrochemical methods and instruments (theory and analytical use)
Oct. 03	Problem solving session
Oct. 08	Radiant energy and matter: Introduction
Oct. 10	Problem Solving Session
Oct. 14	Lab Session
Oct. 15	Spectroscopic methods: Principles of spectrochemical analysis
Oct. 16	Lab Session
Oct. 17	Components and instrumental design of spectroscopic instruments
Oct. 22	Problem Solving Session
Oct. 24	Theory and application of UV/Visible spectrophotometer Theory and application of IR and NMR spectrophotometer
Oct. 28	Lab Session
Oct. 29	Theory and application of atomic absorption spectrophotometer
Oct. 30	Lab Session
Oct. 31	Exam I
Nov. 05	Exam Correction
Nov. 07	Theory and application of atomic absorption spectrophotometer (Cont'd)
Nov. 11	Lab Session
Nov. 12	Assignment I Discussion Theory and application of atomic emission spectrophotometer
Nov. 13	Lab Session
Nov. 14	Assignment II discussion Classification and principles of separation/chromatographic methods
Nov. 19	Theory and application of gas chromatography
Nov. 21	Theory and application of gas chromatography (Cont'd)
Nov. 26	Theory and application of high performance liquid chromatography
Nov. 28	Demonstration Session (Core Environmental Laboratory)
Dec. 03	<i>Assessment Report Correction/Revision</i>
	Final Exam

Enjoy the course!