

**American University of Beirut
Faculty of Arts and Sciences
Department of Chemistry**

**Chem 219: Analytical and Instrumental Chemistry
for
Chemical Engineering Students
Course Syllabus
(3 credits)**

CHEM219 (3CR)

Mondays, Wednesdays and Fridays from 12-12:50

OFFICE HOURS: Tuesday from 3-5 or by appointments

QUIZ DATES: Monday March 5, 2018 at 5 pm and Monday April 9, 2018 at 5 pm, location TBA

Course Description

Chem 219 will provide students a solid knowledge in the chemistry of separation and identification. It introduces students to many analytical techniques and instruments that are widely used in different laboratories in the fields of chemistry, chemical engineering, environmental health, biochemistry, forensic science, toxicology, industrial hygiene, medicine, pharmacology, pharmacy, geology, agriculture, and other industrial applications. Chem 219 is divided into four sections focused on the instrumental aspect in analytical chemistry. The first introductory section presents a review of chemometry and detailed description of the sample preparation techniques. The second section covers a wide range of spectroscopic methods and instruments based on atomic and molecular spectroscopy (components of optical instruments, optical atomic spectrometry, atomic absorption and atomic fluorescence spectrometry, atomic emission spectrometry, molecular luminescence spectrometry). The third section focuses on the separation methods (liquid, gas, supercritical-fluid, chiral and capillary electrophoresis chromatography) and the related hyphenated (coupled) techniques (GC/MS, HPLC/APCI-APPI-ESI/MS) and the fourth section includes the theory and applications of the electroanalytical theory and techniques.

Intended Learning Outcomes

The student should be able to:

1. Improve his/her understanding in chemical analysis especially those related to instrumental chemistry.
2. Acquire a scientific critical approach to chemical analysis problems by choosing the well-adapted analytical instrument.

3. Achieve competence in chemical analysis by adding to his/her basic knowledge in analytical chemistry complementary tools based on up-to-date techniques using novel electronic and optical devices useful in modern analytical chemistry.
4. Understand the perception of quality control/quality assurance in solving analytical problems.
5. Use electrochemical sensors and propose the adequate electrode for a specific ion monitoring in solution.
6. Describe and design spectrophotometers and propose the adequate light source and detector for specific applications.
7. Apply the Beer-Lambert law where appropriate and determine the concentration of molecular species in solutions.
8. Understand the difference between molecular and atomic spectroscopy and the light sources used for atomic absorbance and fluorescence in addition to the different ways mineralization of ions in solution through flame, plasma, furnace, etc.
9. Describe separation techniques including liquid and gas chromatography and their components e.g. columns, injectors, detectors, etc.
10. Choose the appropriate hyphenated chromatographic technique for the determination of organic molecules in solution.
11. Describe the operational mode of relevant apparatus.

Resources Available to Students

Textbook:

Quantitative Chemical Analysis, Daniel HARRIS last edition, Freeman-2010.

Grading Criteria

There will be a series of online quizzes, two exams given during the semester and a final examination to conclude the course. The final grade will be a weighted average of the two class and one online quizzes (25% each) and the final exam (30%). The remaining 20% will be assigned to the Special Project, which will be presented in IBDA2018.

Course Policy

- i. *Attendance:* Students are urged to attend all lectures and classes. If a student misses a lecture or a class, he/she is entirely responsible for the material covered as well as any announcement that was made during class time.
- ii. *Missing a Final Exam:* A make-up for a missed final exam will be given only after the Students Academic Affairs Committee of the Faculty of Arts and Sciences approves the request for such a make-up.
- iii. *Class discipline:* No eating, drinking, smoking or use of mobile phones/beepers is permitted during class time. The instructor reserves the right to dismiss from class, any

student acting in a manner that is considered disruptive or counterproductive to the teaching/learning environment in the classroom.

For all other disciplinary issues, student should consult the Student Code of Conduct on the AUB website at the following link: [http://www.aub.edu.lb/sao/Documents/Revised Student Code of Conduct \(Approved May 2009\).pdf](http://www.aub.edu.lb/sao/Documents/Revised Student Code of Conduct (Approved May 2009).pdf)

Blended Learning

This course will be offered in a blended format. Blended learning is defined as learning that takes place in both a face-to-face format and an online format. This will enable the student to participate more actively, take responsibility for his/her learning, adapt to more flexible time spent on projects and collaborate more effectively with peers and the instructor.

Technical Support

If you face any problems with Moodle or difficulty accessing any of the course resources please contact the IT Academic Core Processes and Systems at EXT 3580 or email: moodle@aub.edu.lb

AUB Policies

Students with Special Needs

AUB strives to make learning experiences accessible for all. If you anticipate or experience academic barriers due to a disability (such as ADHD, learning difficulties, mental health conditions, chronic or temporary medical conditions), please do not hesitate to inform the Accessible Education Office.

In order to ensure that you receive the support you need and to facilitate a smooth accommodations process, you must register with the Accessible Education Office (AEO) as soon as possible: accessibility@aub.edu.lb; +961-1-350000, x3246; West Hall, 314.

Academic integrity

Academic integrity and honesty are central components of a student's education. Ethical conduct maintained in an academic context will be taken eventually into a student's professional career. Academic honesty is essential to a community of scholars searching for and learning to seek the truth. Anything less than total commitment to honesty undermines the efforts of the entire academic community. Both students and faculty are responsible for ensuring the academic integrity of the University. (AUB Student Handbook, p. 33) .

For definitions of cheating and plagiarism as well as the consequences for such, see the AUB "Student Code of Conduct" as found in the Student Handbook (esp. pp. 85-86 and 88) and on the AUB website. <http://pnp.aub.edu.lb/general/conductcode/158010081.html>

Discrimination and Harassment

AUB is committed to facilitating a learning environment that is free of all forms of prohibited discrimination. The University's non-discrimination policy and Title IX apply to, and protect, all students, faculty, and staff. Under Title IX, discrimination based on sex and gender, including sexual harassment, is prohibited. 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, 03-595525, or titleix@aub.edu.lb. Confidential reports may be submitted anonymously online through EthicsPoint at www.aub.ethicspoint.com