This syllabus is provided as a general informational guide. Some of the information may vary depending on the specific course section and instructor. Different sections of the same course may require different textbooks. Verify the section specific textbook information in the CUNY's Academic Course Schedule Web Page. Modifications of the grading system presented here will be communicated by the instructors of the sections when they meet the class.

BOROUGH OF MANHATTAN COMMUNITY COLLEGE
City University of New York

Department of Science

Title of Course: SCIENTIFIC INSTRUMENTATION
SCI 430 Section 134
Semester:
Credits: 4
Class Schedule: *Lecture: Wednesdays 12:00 – 1:40pm (TBA)*
Laboratory: Thursdays 1:00 – 4:40pm (N557)

Class hours: 2
Lab hours: 4
Instructor: ***Abel E. Navarro, Ph.D.***
Office Hours: Monday 12:00-2:00pm and Tuesday 4:00-6:00pm (N699H)
E-mail: anavarro@bmcc.cuny.edu

Course Description

This course covers the theory and practice and quantitative method with special attention to instrumentation currently employed such as optical, electro-chemical and chromatographic techniques. The physicochemical theory and operating characteristics of the instrumentation are stressed. The laboratory emphasizes measurements of biological and environmental significance.

Basic Skills: ACR 095, ENG 088 or ESL 095 and MAT 056.

Prerequisites/Co-requisites: BIO 220, PHY 220, PHY 225, CHE 202, or Department approval.

Student Learning Outcomes

Students will be able to understand, discuss and show proficiency in environmental pollution concepts shown below by being able to apply them to solve new problems.

1. Students will solve and discuss analytical problem systematically, creatively, and reflexively, ready to assemble knowledge and formulate strategy.
2. Students will select an appropriate method or methods to solve a chemical problem.
3. Demonstrate the understanding of modern chemical instrumentation theory.
4. Students will graph and interpret experimental data to extract the maximum information from it.

Assessment: Exam questions, student oral presentation, homework and in-class case studies.

Evaluation & Requirements of Students

Each semester there will be a minimum of three examinations, a comprehensive final examination, and a final student oral presentation. The average of your lecture exams and final exam grades must be greater than 60% to permit a passing grade, regardless of the other grading items.

Below we have the college's general education learning outcomes, the outcomes that are checked in the left-hand column indicate goals that will be covered and assessed in this course. (Check at least one.)

	General Education Learning Outcomes	Measurements (means of assessment for general education goals listed in first column)
☒	**Communication Skills-** Students will be able to write, read, listen and speak critically and effectively.	Students will analyze scientific papers on environmental pollution, short-answer questions in exam, oral presentations in topics related to the course.
X ☐	**Quantitative Reasoning-** Students will be able to use quantitative skills and the concepts and methods of mathematics to solve problems.	Students will quantitatively compare the impact of environmental pollution in living organisms, energy consumption, and maximum allowable pollutant concentrations; by using graph analysis and calculations. Exams, homework, and quizzes.
X ☐	**Scientific Reasoning-** Students will be able to apply the concepts and methods of the natural sciences.	Exam questions, homework assignment and case study on new approaches towards solving environmental contamination in our planet. Potential solutions and alternative technologies will be discussed in class. Exams, quizzes and homework.

Required Text & Readings

Analytical Chemistry by Gary Christian, Purnendu Dasgupta, Kevin Schug, John Wiley & Sons, Inc., 2014, 7th Edition. ISBN-978-0-470-88757-8. E-text: ISBN-978-1-118-80516-9

Other Resources (Highly recommended)

Analytical Chemistry: A Guided Inquiry approach quantitative analysis collection by Juliette Lants and Renee Cole, The POGIL Project, John Wiley & Sons, Inc., 2014. ISBN 978-1-118-89131-5

The students are encouraged to read the lecture slides before every class and analyze the case studies found at the end of the chapter until the main content of the chapter is mastered. The instructor will periodically post on Blackboard links and visual resources for a better understanding of the materials covered in class.

Grading Policy:

3 Exams	30 %
Lab Notebook	20 %
Final Exam lab	10 %
Final Exam	20 %
Homework/Participation	10 %
Oral presentation	10 %

Outline of Topics

Date	Chapter	Lecture Topics
Feb 1		***Introduction and Review of Basic Chemical Calculations.*** Limiting reagent, equilibrium constant, thermodynamics, graphing and plotting of experimental results. Instructions for laboratory notebook.
Feb 8	**13**	***Potentiometric Titrations. 13.7 – 13.17*** Voltaic cells, reference electrodes, glass pH electrode, standardization buffers, using pH meter, applications.
Feb 22	**16**	***Spectrochemical Methods Part I. 16.1, 16.6, 16.7, 16.9.*** Electromagnetic radiation, Solvent in spectrometry, Quantitative calculations, Beer's law, Types of instruments.
Mar 1	**16**	***Spectrochemical Methods Part II. 16.13, 16.14, 16.15, 16.16.*** Spectrometric errors, Deviations from Beer's law, Fluorometry, Chemiluminescence.
Mar 8		**EXAM I (CHAPTERS Introduction, 13, 16). Deadline HW 1.**
Mar 15	**PowerPoint slides**	***Infrared Spectroscopy*** IR radiation, Vibrational spectroscopy, Identification of organic compounds, Structure determination.
Mar 22	**PowerPoint slides**	***Nuclear Magnetic Resonance*** Nuclear spin, NMR instrumentation, Solid state NMR, Identification of hydrogen atoms in organic compounds. Structure determination.
Mar 29	**17**	***Atomic Spectrometric Methods. 17.1, 17.2, 17.3, 17.4, 17.6, 17.7.*** Principles, Atomic Absorption, Atomic Emission and Atomic Fluorescence Spectrometry.
Apr 5		**EXAM II (CHAPTERS 16 and 17). Deadline HW 2.**
Apr 19	**19**	***Chromatography: Principles and Theory. 19.1 - 19.4.*** Principles, Chromatographic techniques, column efficiency. Stationary and Mobile phases.
Apr 26	**20,21**	***Gas and Liquid Chromatography. 20.1-20.5, 20.10. 21.2, 21.2, 21.4, 21.8, 21.9.*** GC Separations, columns, detectors, quantitative determinations, separation of chiral compounds. HPLC analysis, Thin layer chromatography, electrophoresis.
May 3	**23**	***Kinetic Methods and Analysis. 23.1-23.3.*** Basics of Kinetics, Catalysis and Enzymatic catalysis,
May 10		**EXAM III (CHAPTERS 19, 20, 21, and 23). Deadline HW 3.**
May 17	**26**	***Environmental Sampling and Analysis*** Air, water, soil and sediment sampling and analysis. Contaminated Land sites and EPA methods and analyses.
May 24		**FINAL EXAM (All chapters)**

Lab Schedule – SCI 430

DATE	EXPERIMENTS FOR SCIENTIFIC INSTRUMENTATION
Feb 2	Safety Video. Introduction to plotting and use of software.
Feb 9	Determination of the pH of Hair Shampoos (EXP 14)
Feb 16	Potentiometric Determination of Fluoride in Drinking Water Using a Fluoride Ion-Selective Electrode. (EXP 15).
Feb 23	Spectrophotometric determination of iron. (EXP 23).
Mar 2	Spectrophotometric determination of inorganic phosphorus in serum. (EXP 27).
Mar 9	Ultraviolet Spectrophotometric Determination of Aspirin, Phenacetin, and Caffeine in APC Tablets Using Solvent Extraction. (EXP 30).
Mar 16	Elucidation of organic compounds by FTIR (HANDOUT)
Mar 23	Elucidation of organic compounds by NMR (HANDOUT)
Mar 30	FIELD TRIP 1
Apr 6	Student Oral Presentations
Apr 27	Thin Layer Chromatography separation of amino acids. (EXP 36).
May 4	Spectrophotometric determination of lead on leaves using solvent extraction. (EXP 26).
May 11	FIELD TRIP 2
May 18	FINAL EXAM LAB

College Attendance Policy
At BMCC, the maximum number of absences is limited to one more hour than the number of hours a class meets in one week. For example, you may be enrolled in a three-hour class. In that class, you would be allowed 4 hours of absence (not 4 days). In the case of excessive absences, the instructor has the option to lower the grade or assign an F or WU grade.

Academic Adjustments for Students with Disabilities
Students with disabilities who require reasonable accommodations or academic adjustments for this course must contact the Office of Services for Students with Disabilities. BMCC is committed to providing equal access to all programs and curricula to all students.

BMCC Policy on Plagiarism and Academic Integrity Statement
Plagiarism is the presentation of someone else's ideas, words or artistic, scientific, or technical work as one's own creation. Using the idea or work of another is permissible only when the original author is identified. Paraphrasing and summarizing, as well as direct quotations require citations to the original source. Plagiarism may be intentional or unintentional. Lack of dishonest intent does not necessarily absolve a student of responsibility for plagiarism.

Students who are unsure how and when to provide documentation are advised to consult with their instructors. The library has guides designed to help students to appropriately identify a cited work. The full policy can be found on BMCC's web side, www.bmcc.cuny.edu. For further information on integrity and behavior, please consult the college bulletin (also available online).