

City College of San Francisco
 Course Outline of Record
 Course Status: Active

I. GENERAL DESCRIPTION

A. Approval Date	February 2015
B. Effective Semester	Fall 2015
C. Department	Engineering & Technology
D. Course Number	EMSA 30A
E. Course Title	Water Quality Analysis by Anion-based Chromatography
F. Course Outline Originator	Gregory Langland
G. Department Chairperson	Hitesh Soneji
H. Dean	David Yee

II. COURSE SPECIFICS

A. Hours	Lecture: 12.00 total Lab: 12.00 total
B. Units	0.50
C. Prerequisite	None
Corequisite	None
Pre/Corequisite	None
Advisory	None
Advisory Pre/Corequisite	Completion of or concurrent enrollment in: EMSA 22 or EMSA 28
D. Course Justification	EMSA 30A is designed to provide practical experience using current techniques in automated ion chromatography systems. These methods are currently used by various private and public governmental agencies such as the EPA, USGS, water treatment plants, environmental firms and the FDA.
E. Field Trips	Optional
F. Method of Grading	Letter or Pass/No Pass
G. Repeatability	Course is not repeatable

III. CATALOG DESCRIPTION

Students will be taught the theory and practical applications of ion chromatography as it relates to water and drug quality analysis; identification and quantification of anions and other small molecules. This course will specifically study (EPA-Method-300.1A) and other standard methods used in both environmental and drug analyses.

IV. STUDENT LEARNING OUTCOMES

Upon completion of this course, a student will be able to:

- A. Identify major uses of liquid and gas chromatography systems
- B. Diagram major components of an ion chromatography system then operate the system
- C. Evaluate the principles of solid vs. liquid phases, wash solutions, retention times, and conductance peaks
- D. Compare and contrast EPA-based and standard methods
- E. Identify, measure and quantify ions in solution
- F. Analyze and assess simple data sets from known and unknown water sources

V. CONTENTS

- A. Basic chromatography concepts
 1. Introduction to chromatography
 - a. High pressure liquid chromatography
 - b. Fast protein liquid chromatography
 2. Principles of Separation
 - a. Charge
 - b. Size

- c. Affinity
- 3. Ion and small molecule detection principles
 - a. Specific conductance
 - b. UV absorbance
- B. Quality assurance and quality control concepts
 - 1. Blanks
 - a. Field blanks
 - b. Laboratory blanks
 - 2. Internal controls
 - 3. Standards check
 - 4. Spiked samples
 - 5. Good documentation principles
 - a. Physical
 - b. Electronic
- C. Sample preparation and solution preparation
 - 1. Sample and column preparation
 - a. Pre column filtration
 - b. Column equilibration
 - 2. Solution preparation
 - a. Volumetric and gravimetric principles
 - b. Degassing solutions
 - c. Antimicrobial agents
 - 1. Sodium azide
 - 2. Pro clin 300
- D. Setup and programming of ion chromatography system
 - 1. Setup of auto-sampler
 - 2. Unit calibration
 - 3. Run time determination
 - 4. Standard selection and data storage preferences
 - 5. Data analysis
- E. System maintenance
 - 1. Hardware maintenance
 - a. Auto-sampler
 - b. Column
 - 2. Software maintenance
- F. US EPA method 300.1A
 - 1. Ions
 - 2. Instrumentation
 - 3. Calibration standards
 - 4. Blank solutions
 - 5. Required antimicrobial agents
 - 6. Check standards and internal calibration standards
 - 7. Elution methods

VI. INSTRUCTIONAL METHODOLOGY

A. Assignments

- 1. **In-class assignment:** Discussions and small group work on sample preparation and instrument work
- 2. **In-class assignment:** Written and oral activities or assignments that provide skills in topics such as the role of the US EPA and water quality management
- 3. **In-class assignment:** Optional field trips, such as 1. Visit a water treatment facility using ion chromatography (SFPUC or EBMUD) 2. Visit private water quality engineering firm
- 4. **Out-of-class assignment:** Written laboratory reports describing and analyzing experimental results
- 5. **Out-of-class assignment:** Weekly readings from textbook and handouts
- 6. **Out-of-class assignment:** Research and experiment on a water source related to ion chromatography and prepare a written or oral presentation of findings
- 7. **Out-of-class assignment:** Independent Projects, such as 1. Students generate a question of interest and independently answer question using the Scientific Method and proper QA/QC procedures to produce reliable data using ion chromatography testing various drinking water sources with EPA Method 300.1A for compliance, anion analysis from different brands of bottled water, determination of the levels of fluoride from various brands toothpastes 2. Reading assignments on water quality topics pertinent to the Bay Area

B. Evaluation

1. **Participation:** Discussions and small group work on sample preparation and instrument work will be evaluated by written laboratory reports.
2. **Exams/Quizzes/Tests:** EPA methodology and class handouts will be evaluated by oral presentations and written exams.
3. **Written work:** Written laboratory reports will be graded on the following criteria 1. Using current standards for proper documentation of scientific procedures and results 2. Scientific accuracy in describing procedures and results
4. **Exams/Quizzes/Tests:** Weekly readings from textbook and handouts 1. Written quizzes, on topics such as US EPA method 300.1A and principles of separation 2. Written final exam
5. **Research project:** Research topics related to ion chromatography will be evaluated by an oral report
6. **Written work:** Independent projects and out of class reading assignments will be evaluated by written reports
7. **Final Assessment:** Written final exam on topics such as column selection, proper usage of check standards, EPA 300.1A and anion identification

C. Representative Textbooks and Other Instructional Materials

1. Ion Chromatography, 2E by Joachim Weiss, 2nd Edition, 2008, VCH Publishers, Inc.
2. Powerpoint files created by instructor on topics such as instrument setup, equilibration, sample filtration and application and data analysis
3. Course website- <https://sites.google.com/site/ccsfbtcecmsa30/>
4. Various governmental and individual company websites-such as those representing US EPA, USGS, FDA, and Metrohm A/G

VII. TITLE 5 CLASSIFICATION

CREDIT/DEGREE APPLICABLE (meets all standards of Title 5. Section 55002(a))

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