

CEE 772 – INSTRUMENTAL METHODS IN ENVIRONMENTAL ANALYSIS
Fall Semester 2019

Catalog Description	CEE 772: Instrumental Methods in Environmental Analysis. Credit 3. Principles and techniques of instrumental chemical analysis, including molecular and atomic spectrophotometry, gas chromatography, mass spectrometry, and electroanalytical methods. Emphasis on solving analytical problems of trace pollutants in water and wastewater. Prerequisite: CEE 370 or equivalent.
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Prerequisites by Topic:

1. CEE 370, Basic understanding of Environmental Engineering and Water Quality Parameters.

Schedule: Tu 2:30 (Marston 211), MW 12:20-1:35 (Elab II, room 118)

Textbook: Skoog, Holler & Crouch, Principles of Instrumental Analysis, 6th ed. Brooks Cole Publ., 2006.

References:	<ol style="list-style-type: none">1. Harris, <u>Quantitative Chemical Analysis</u>. 7th Ed., Freeman, 20062. APHA, AWWA, WPCF, <u>Standard Methods for the Examination of Water and Wastewater</u>, APHA, 2012.
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Instructors:	David A. Reckhow, Professor of C.E.E. 16C Marston, 545-5392, reckhow@ecs.umass.edu Aarthi Mohan (TA), Doctoral Candidate, CEE 312 Elab II, 781-929-7619, aarthi1391@gmail.com
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Objectives:	<ol style="list-style-type: none">1. To provide a fundamental understanding of the principles, capabilities, and limitations of modern chemical analysis as used in the environmental field;2. To provide a practical understanding of the use of analytical instruments for the analysis of environmental samples;3. To provide the student with the background necessary to understand the current scientific literature that pertains to environmental chemical analysis.
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Outcomes:	<ol style="list-style-type: none">1. Ability to analyze waters and wastewaters for a wide range of advanced chemical characteristics (e.g., specific organic and inorganic contaminants, TOC, TOX).2. Ability to interpret results from laboratory tests, and assess QA/QC data.3. Ability to suggest remedies to common analytical problems encountered in the testing of water4. Ability to work confidently, efficiently and safely in an environmental engineering laboratory.5. Ability to present laboratory data in a clear and concise manner
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Outcome Measures and Assessment:	<ol style="list-style-type: none">1. Weekly laboratory exercises demonstrating principles covered in class2. Two exams of a comprehensive nature testing comprehension from homeworks, class lectures, and readings.3. Detailed term paper presenting use, operation and applicability of a major environmental analytical instrument4. In-class presentation of the fundamentals and application of analytical instrumentation by the students.
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Grading Criteria: (attendance is required)

Two exams (mid-term & final)	30%
Lab/class presentation	20%
Instrument Report	30%
Review Papers/ literature critiques	20%
	100%

			Readings	
	<u>Week of</u>	<u>TOPICS:</u>	<u>Harris,</u> <u>5th Edition</u> <u>(optional)</u>	<u>Skoog et al., 5th</u> <u>Ed. (required)</u>
Sept	2	Introduction	Chapter 0 to 2	Chapter 1
	9	Spectroscopy	Chapter 19 to 20	pp.134-140,143-147,154-182, Chapt 13
	16	UV-Vis Molecular Spectroscopy	Chapter 21	Chapter 14
	23	Atomic Absorption Spectroscopy	Chapter 22	Chapter 9
	30	Infrared Spectroscopy, TOC		pp.380-383,399-400
Oct	7	TOX; Sample Prep	Chapter 28	Chapter 22
	14	Chromatography	Chapter 23	Chapter 26
	21	Gas Chromatography	Chapter 24	Chapter 27
	28	Liquid Chromatography: RP-HPLC	Chapter 25	Chapter 28
Nov	4	Env. Applications of GC & HPLC		
	11	Ion Chromatography	Sect. 26-1, 26-2	
	18	Mass Spectrometry: GC/MS		Chapter 20
	25	Thanksgiving recess		
Dec	2	(continuation) and Mass Spectrometry: LC/MS, LC/MS/MS		

Laboratory (or mini-lectures):

<u>Lab Date</u>	<u>Subject</u>
Sep 10	UV-Vis Spectrophotometry
17	No Lab
24	Atomic Absorption Spectrophotometry
Oct 1	Fluorescence
8	Organic Carbon Analyzer (and peCOD)
15	No lab
22	TOX
29	Sample Preparation for GC
Nov 5	Gas Chromatography
12	ICP – Mass Spectrometry
19	Liquid Chromatography - Mass Spectrometry
Dec 3	Gas Chromatography - Mass Spectrometry

CEE 772 Website:

<http://www.ecs.umass.edu/cee/reckhow/courses/772/>