Department of Civil & Environmental Engineering

CEE 209L Environmental Chemistry

COURSE OUTLINE *FOR* SUMMER 2018

Students are recommended to preserve this course outline for future use in support of applications for employment or transfer of credits.

Instructor	:	Samia Davina Rahman
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Office Room	:	SAC-1046-B
Consultation Hours	:	8 am to 9 am Wednesday
		12 pm – 2 pm Wednesday
Class Hours	:	2:40 pm – 5:50 pm Wed Lib 001 Section 2
		8:00 am – 11:10 am Thu Lib 610 Section 3
Section	:	2 & 3
Course Objective	:	This course provides an up-to-date and holistic coverage of the most important analytical chemistry methods used in the field of environment.
Course Description	:	This course introduces students to the application of analytical chemistry to environmental problems. It begins with the concepts necessary for a study of the environment. This enables students to gain an understanding of how pollutants may be transported in the environment, and the role of analytical chemistry in the monitoring of these pollutants. The remaining course content covers the analysis of water, solids and atmospheric samples. The special problems of ultra-trace analysis are also considered.

Learning Outcomes : Upon successful completion of this course, the student will have reliably demonstrated the ability to:

1. Plan out an experimental procedure and develop good lab techniques;
2. Conduct accurate chemical analyses on environmental samples;
3. Interpret chemical data on environmental samples;
4. Write both short and long reports describing their work and interpreting the significance of the results.

Course Content : 1. The Necessity of Analysis

Pollutants are often materials which are naturally present in the environment, their adverse effects being caused by concentrations higher than those which would be expected from natural causes. A study of pollution would then involve a large amount of quantitative chemical analysis. Analytical chemistry is also involved in devising pollution control procedures, in drafting legislation and in monitoring the effect of any control procedure. In fact, analytical chemistry is a necessary component in almost all aspects of scientific investigations of the environment, the problems caused by mankind and their possible solution.

2. Transport of Pollutants in the Environment

Pollutants travel through the environment by routes which can be predicted from their chemical and physical properties. Pollutants of major concern include high relative molecular mass neutral organic compounds and metals. They are capable of concentrating in certain areas and within organisms and it is in these areas that they have their greatest effect. An understanding of such routes is needed for the correct choice of sampling positions for subsequent analytical determinations.

3. Water Analysis (Major Constituents)

The composition of water changes continuously as it travels in the environment. Sampling at a large number of locations is necessary to monitor these changes. Careful choice of locations, sampling time and sampling storage procedures are necessary for reliable monitoring. The quality of water can be assessed using measurements relating to the overall effects of groups of compounds or ions (water quality parameters) and by analysis of the major individual components. Methods for

both types of determination have been discussed and include volumetric and instrumental methods.

4. Water Analysis (Trace Pollutants)

Components present at trace levels can have a major effect on water quality if they can bioaccumulate in organisms or have a high degree of toxicity. These components usually fall into the two categories of organic pollutants and metal ions. Instrumental methods for the determination of the components have been discussed along with the necessary extraction and pretreatment steps. The predominant instrumental technique for the organic components is gas chromatography whereas atomic spectrometric techniques are the most frequently used methods for metal ion analysis. .

5. Analysis of Solids

The extraction and dissolution techniques from solids to solubilise the components of interest is examined here. The analysis can then be proceed by the instrumental techniques which have already been discussed. Solids which are of importance in studying the environment include animal and plant specimens, soils, sediments and sewage sludge and atmospheric particulates. Specific extraction and dissolution procedures have been discussed for each type of solid except atmospheric particulates.

6. Atmospheric Analysis (Gases)

The types of pollutant found in outdoor atmosphere and in indoor atmosphere can differ in chemical type and in concentration, higher concentrations often being found with internal atmospheres. The concentrations can often change rapidly with time. Concentrations averaged over a fixed time period are the most appropriate measurement for long-term investigations. A detailed study of a pollution incident would, however, require instantaneous concentration measurements. Methods have been discussed for both of these types of measurement, and include techniques which determine concentrations directly in the field and techniques requiring the analysis to be completed in the laboratory.

7. Atmospheric Analysis (Particulates)

Particulate material is an essential and natural component of the atmosphere. Much airborne pollution is, however, also in the form of particulate material. Analysis of the material starts with sampling from the atmosphere. This is often by filtration. The method used for the chemical analysis depends on the ease of solubility of the material. If the substance is readily dissolved then the analysis can proceed using techniques for species in solution.

8. Ultra-trace Analysis

Some species have such a great ability to bioaccumulate and such a high degree of toxicity that monitoring their presence is necessary. The analyses not only require highly sensitive and selective instrumentation but also a large degree of analytical skill and expertise. Gas chromatography-mass spectrometry is most often used. The technique has been discussed along with the necessary clean-up and concentration stages.

Course Assessment : Laboratory/Field Experiments There will be a total of 8 laboratory sessions held in a semester. Each session will consist of a short briefing before proceeding to conducting experiments related to the course content. Students may be required to go for field visits in order to collect samples. Each laboratory session will consist of 12.5 marks worth of assessment.

Textbooks :

1. Environmental Analysis by Roger N. Reeve
2. Environmental Chemistry by A K DE
3. Chemistry for Environmental Engineering by Clair N. Sawyer, Perry L. McCarty & Gene F. Parkin

Important Notes : Instructor reserves the right to change or alter the course material as deemed necessary as the class progresses.

Grades will be assigned on the basis of NSU grading policy.

Remember that cheating or plagiarism in any of the exams or assignments will lead to an F grade.

Turn off your phones before you enter into the class room or the exam hall.