ENGI 9628 Environmental Laboratory

TERM: Spring 2009

INSTRUCTORS: Dr. Bing Chen
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LECTURES: 2:00-5:00 PM, Wed, EN-2064

LABS: 1:30-4:30 PM, Wed, C3046

OFFICE HOURS: Dr. Bing Chen - Afternoon, Mon to Fri. You’re welcome to try my offices any time or send me an Email.
Jing Ping - 10:00 AM to 12:00 NOON, Mon & Fri.

COURSE WEBSITE: http://www.engr.mun.ca/~bingchen/en9628.htm
Lecture notes and lab handouts, as well as important notices regarding the lab schedule and the deadlines, will be posted on this web site in due course. Please do check it frequently and especially before you go to classes.

DESCRIPTION AND OBJECTIVES:
This is a 3-credit hour laboratory course offered to graduate students. The overall goal of this course is to introduce student to unit operations and unit processes in environmental engineering. Within the context of the overall goal, specific learning objectives will be pursued. At the end of the course, students should be able to:
- understand the key element of The Workplace Hazardous Materials Information System (WHMIS),
- operate various water, air and soil sampling and analyzing instruments,
- predict the standard error in a measurement given quantifiable uncertainty in the measurement instrument, and
- write a legally defensible laboratory notebook.
This course will involve collaborative, problem-based learning within a laboratory context.
## LECTURE TOPICS AND LAB EXERCISES

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<th>TOPIC/LAB EXERCISE</th>
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<td>• Lab reports, lab notebooks, journal review and term paper</td>
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<td>• Final presentation of term paper and exam.</td>
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<td><strong>Lecture and Laboratory #1</strong></td>
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<td>• Safety in environmental lab</td>
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<td>• Workplace Hazardous Materials Information System (WHMIS).</td>
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<td>• Environmental sampling</td>
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<td>• Sampling techniques for soil, sediment, water, and plants</td>
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<td>• Errors in sampling techniques and analysis.</td>
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<td>5-6</td>
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<td>• Hardness of water <em>(Lab #3)</em></td>
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<td>• Water Chemistry</td>
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<td>• Determination of biochemical oxygen demand (BOD)</td>
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<td>• Determination of dissolved oxygen (DO) in water using the Winkler method</td>
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<td>• Determination of chemical oxygen demand (COD).</td>
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<td>• Acid-base chemistry - carbonate system</td>
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<td>• Soil chemistry</td>
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<td>• Soil pH, soluble salts, carbonates and organic matter content.</td>
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<td>• Soil analysis</td>
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<td>• UV spectroscopy and gas chromatography.</td>
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<td>• Determine optimum lab operating conditions</td>
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<td>• Air analysis</td>
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<td>• TSP and PM$_{10}$</td>
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<td>11</td>
<td><strong>Lecture</strong></td>
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<td>• Statistical analysis, and uncertainties</td>
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• Instrumental analysis
• Fundamental of electrochemistry
• Electrodes and potentiometry
• Chromatographic methods
• Inductively coupled plasma optical emission spectroscopy

Presentation of Term Paper

TEXTBOOK AND REFERENCES:
1) Handouts distributed in class, and from the course web site.

GRADING SCHEME:
1) Lab Reports (Individual) 30%
2) Laboratory Notebook (Group) 5%
3) Individual performance in lab exercises 5%
4) Journal Reviews 10%
5) Term Paper and Presentation 20%
6) Final Exam 30%

1) Laboratory Report Grading (30%)
• Students are required to submit lab report individually, although the lab exercises are conducted in groups.
• Each lab is worth 100 points. Of these, 5 points are reserved as “discretionary” points, to be awarded as a measure of adequately completion of the Before Lab Questions (if any). The reminder of each lab report, then, may earn a maximum possible score of 95 points. Points will be awarded based on answers to lab questions, explanation of the data, error analysis, neatness, spelling, and grammar.
• Lab reports are typically due within one week of assignment. Five points will be deducted for each day that the lab report is late. In addition, 50 points will also be deducted for missing a laboratory session without prior permission.
• The final lab report grade will be an average over all the experiments.
• Lab handouts will be distributed one week before laboratory exercise. The Before Lab Questions are distributed at this time and must be turned in on the day of the laboratory session.
• The format of the lab report is explained in the handout: “Lab Report write-Up”.

2) Laboratory Notebook (5%)
• Each laboratory group must maintain a laboratory notebook (ONE book for each group) that contains the data collected by each group during the course.
• The first two pages of the laboratory notebook should be reserved for a Table of Contents. The Table of Contents should be updated after each laboratory exercise.
• The laboratory notebook should include the raw data and measurements made during each lab. The date and name of all lab partners present should be given for each experiment. One student should act as “Recorder” for each laboratory, and
role of each group member for each laboratory exercises should be clearly identified in the notebook. Students are suggested to play different roles throughout the course.

- Laboratory notebooks from each group will be collected at the end of the semester. A grade will be assigned based upon adequacy and neatness of the notes.

3) Individual Performance (5%)
- Each student will be evaluated for his/her performance in lab exercises.

4) Journal Review (10%)
- Students are required to submit TWO journal reviews related to this course. The purpose of this review is to help the student improve their skills on literature searching and English writing.
- The tentative deadlines for submission of the two reviews are June 3rd and July 2nd, respectively.
- Students are required to ask instructor for approval of proposed topics. One example of acceptable title is shown on the next page (under the section of “Term Paper”).
- Sample Journals (2004-2008 publications):
  - Environmental Science and Technology
  - Science of the Total Environment
  - Journal of Environmental Engineering and Science
  - ASCE Journal of Environmental Engineering
  - Water, Air, & Soil Pollution
  - Atmospheric Environment
  - Water Resources Research
  - And many more…

5) Term Paper (15%)
- Students are required to submit a term paper related to this course by August 1st, 2008 (tentative). The possible topics should focus on one of the following areas:
  - Development of analytical instruments, historic aspect of view;
  - Comparison of different analytical methods;
  - New experimental and sampling/monitoring technologies for environmental engineering practice and research;
  - Reports on your own lab analysis for a specific case.
- Students are required to submit a proposal at least 4 weeks ahead of the deadline. The proposal should include the paper title, abstract, and outline, as well as your name and affiliation. One example of acceptable proposal is shown below:

| Carbon and nitrogen stable isotopes and metal concentration in food webs from a mining-impacted coastal lagoon |
| Lázaro Marín-Guirao, Javier Lloret and Arnaldo Marin |
| Departamento de Ecología e Hidrología, Facultad de Biología, Universidad de Murcia, 30100-Murcia, Spain |

Abstract
Two food webs from the Mar Menor coastal lagoon, differing in the distance from the desert-stream through which mining wastes were discharged, were examined by reference to essential (Zn and Cu) and non-essential (Pb and Cd) metal concentrations and stable isotopes content (C and N). The partial extraction technique applied, which reflects the availability of metals to organisms after sediment ingestion, showed higher bioavailable metal concentrations in sediments from the station influenced by the mining discharges, in
agreement with the higher metal concentrations observed in organisms, which in many cases exceeded the
regulatory limits established in Spanish legislation concerning seafood. Spatial differences in essential metal
concentrations in the fauna suggest that several organisms are exposed to metal levels above their regulation
capacity. Differences in isotopic composition were found between both food webs, the wadi-influenced station
showing higher δ¹⁵N values and lower δ¹³C levels, due to the discharge of urban waste waters and by the
entrance of freshwater and allochthonous marsh plants. The linear-regressions between trophic levels (as
indicated by δ¹⁵N) and the metal content indicated that biomagnification does not occur. In the case of
invertebrates, since the “handle strategy” of the species and the physiological requirements of the organisms,
among other factors, determine the final concentration of a specific element, no clear relationships between
trophic level and the metal content are to be expected. For their part, fish communities did not show clear
patterns in the case of any of the analyzed metals, probably because most fish species have similar metal
requirements, and because biological factors also intervened. Finally, since the study deals with metals,
assumptions concerning trophic transfer factors calculation may not be suitable since the metal burden originates
not only from the prey but also from adsorption over the body surfaces and seawater ingestion.

Article Outline
1. Introduction
2. Materials and methods
   2.1. Study area and sampling sites
   2.2. Sampling collection and processing
   2.3. Sediment analyses
   2.4. Trace metal analysis of biological samples
   2.5. Stable isotope analysis
   2.6. Data analysis
3. Results
   3.1. Sediment analyses
   3.2. Metal concentrations in lagoon organisms
   3.3. Isotopic composition in lagoon organisms
   3.4. Relationships between metal content and trophic level
4. Discussion
Acknowledgements
References
(Source: Science of The Total Environment, Volume 393, Issue 1, 1 April 2008, Pages 118-130)

- Your purpose is to create NEW knowledge while recognizing those scholars whose
  existing work has helped you in this pursuit, you are honor bound never to commit
  the following academic sins:
  - **Plagiarism**: Literally “kidnapping,” involving the use of someone else’s words
    as if they were your own. To avoid plagiarism you must document direct
    quotations, paraphrases, and original ideas not your own.
  - **Recycling**: Rehashing material you already know thoroughly or, without your
    professor’s permission, submitting a paper that you have completed for another
    course.
  - **Premature cognitive commitment**: Academic jargon for deciding on a thesis
    too soon and then seeking information to serve that thesis rather than
    embarking on a genuine search for new knowledge.

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http://www.mun.ca/writingcentre/

PowerPoint Presentation of Term Paper (5%)
• In the last class, students are expected to give an oral presentation of their term paper.
• The oral presentation is usually limited to a **12-minute** presentation of your paper, followed by a **3-minute** question & answer period.
• Speakers are suggested to use Microsoft PowerPoint. It is an honor to have the opportunity of being in the spotlight with an audience of peers giving you their time and attention. You have an obligation to them (and to your profession) to use that occasion wisely and well.
• Recommendations in preparing your talk:
  − Decide on a limited number of the significant ideas you want your audience to code, comprehend, and remember.
  − Minimize details (of procedure, data analysis, and literature review) when highlighting the main ideas you want to transmit.
  − State clearly in simple, jargon-free terms what the point of the research is, what you discovered, and what you think it means--its conceptual, methodological, or practical value.
  − Employ some redundancy in repeating important ideas to enhance comprehension and recall.
  − Write out your presentation as a mini-lecture (with a listening audience in mind), starting with an outline that you expand into a narrative.
  − Practice delivering it aloud in order to learn it well, to make its length fit in the time allocated, and to hear how it sounds.
  − Do not read your paper. Speak your ideas directly to your audience, referring--if necessary only--to an outline of key points and transitions.
  − Try to speak loud enough, clear enough, and with sufficient enthusiasm to hold the attention of your audience despite distractions (internal and external).
  − State your final conclusions and end on time.
  − Get feedback both from tape-recorded replay of your delivery and from critical colleagues who listen to it.

6) Final Exam (30%)
• Close book
• In the end of the Spring term