CIVE 310 – Environmental Engineering
Term – SPRING 2016 (201601)

Instructor | Office Hours
--- | ---
Dr. John Brereton, P. Eng. | Days: TBA
Phone: TBA | Time: TBA
E-mail: brereton@uvic.ca | Location: TBA

Prerequisites and co-requisites: CIVE 210 and either EOS 110 and 120, or GEOG 103

LECTURE DATE(S)

<table>
<thead>
<tr>
<th>Section: A01 / 20574</th>
<th>Days:</th>
<th>Time:</th>
<th>Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>10:00 am – 11:20 am</td>
<td>Cornett A229</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>8:30 am – 9:50 am</td>
<td>MacLaurin D110</td>
<td></td>
</tr>
</tbody>
</table>

TUTORIAL SECTIONS

<table>
<thead>
<tr>
<th>Section: T01 / 20579</th>
<th>Days:</th>
<th>Time:</th>
<th>Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>11:30 am – 12:20 pm</td>
<td>ECS 104</td>
<td></td>
</tr>
</tbody>
</table>

LAB SECTIONS

<table>
<thead>
<tr>
<th>Section: B</th>
<th>Days:</th>
<th>Time:</th>
<th>Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td>B01 / 20575</td>
<td>M (alt weeks)</td>
<td>4:30 pm – 7:20 pm</td>
<td>ISC 371</td>
</tr>
<tr>
<td>B02 / 20576</td>
<td>M (alt weeks)</td>
<td>4:30 pm – 7:20 pm</td>
<td>ISC 371</td>
</tr>
<tr>
<td>B04 / 20578</td>
<td>T (alt weeks)</td>
<td>4:30 pm – 7:20 pm</td>
<td>ISC 371</td>
</tr>
</tbody>
</table>

Lab times and locations are also available from the timetable through Sign in to UVic, My Page.

<table>
<thead>
<tr>
<th>TA Name</th>
<th>E-mail</th>
<th>Office</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vahid Moradi</td>
<td><a href="mailto:vmoradi@uvic.ca">vmoradi@uvic.ca</a></td>
<td>TBA</td>
</tr>
<tr>
<td>Zhiying (Sunny) Xu</td>
<td><a href="mailto:zhiyingx@uvic.ca">zhiyingx@uvic.ca</a></td>
<td>TBA</td>
</tr>
</tbody>
</table>

Required Text | Optional Text
--- | ---
Title: Environmental Engineering | None
Authors: Mihelcic & Zimmerman
Publisher/Year: Wiley (2014)

Reference Materials: Additional material will be posted on the course web site
COURSE OBJECTIVES:
Course lectures will cover the fundamentals of Environmental Engineering including the mathematics, chemistry, physics, and biology a practicing Environmental Engineer is expected to know. Emphasis will be on water quality, wastewater treatment, water reuse, stormwater management, solid waste management, and air quality. Sustainability approaches and the Instructor’s professional experiences will be integrated into the course material where appropriate. The laboratory component will provide the opportunity for hands-on experience with a sampling of common Environmental Engineering analyses.

LEARNING OUTCOMES: At the end of this course, students will be able to:
- Explain the importance of advancing sustainability through engineering design and innovation
- Describe different units used to measure pollutant levels in aqueous (water), soil/sediment, atmospheric, and global systems
- Know various methods for converting between different units
- Understand the basic properties of water
- Calculate and apply activity coefficients and ionic strength
- Write and apply equilibrium constants for volatilization, air-water reactions, acid base reactions, oxidation-reduction reactions, precipitation-dissolution reactions, and sorption reactions
- Apply the Ideal Gas Law to problems of gas volumes, pressures, and quantity (number of moles)
- Apply Henry’s law and other equilibrium relationships to problems of partitioning among different environmental media
- Recognize the differences between zero-order, first-order, and pseudo first order reactions
- Understand and apply the principles of the natural carbonate system
- Recognize and understand that some elements exist in more than one oxidation state
- Calculate the oxidation state of several elements in compounds based on standard oxidation states of oxygen, hydrogen, and the overall charge of the compound
- Estimate how concentrations will change during the course of reactions using kinetic rate expressions for zero-order, first-order, and pseudo first-order reactions
- Explain partitioning of contaminants between phases by sorption
- Estimate how concentrations will change during the course of reactions using kinetic rate expressions for zero-order, first-order, and pseudo first-order reactions
- Understand fundamental physical parameters and processes used in environmental engineering (total solids, dissolved solids, suspended solids, volatile solids, fixed solids, and turbidity)
- Identify physical water quality parameters and typical ranges found in water quality applications
- Apply common physical units used in water demand, water/wastewater system planning and design
- Explain and apply the physics of discrete particle settling
- Apply Stoke’s Law for the removal of particles from water
- Understand the combined processes of coagulation and flocculation in the removal of particulates in water treatment
- Understand how stable particles and colloidal material are destabilized by coagulation
- Explain how flocculation increases the settleability of suspended solids
- Design rapid mix coagulation treatment units and slow mix flocculation basins based on design criteria
- Know how chlorine disinfection is applied in drinking water treatment
- Explain the differences between free and combined chlorine
- Define the concept of breakpoint chlorination
- Apply the basics of disinfection kinetics and Chick’s Law
- Explain the concepts of Ct and t10 as applied to required inactivation levels for drinking water
- Discuss the basic concepts of microbiology as applied to disinfection of drinking water
- Describe some of the indicators used in assessing the microbial quality of drinking water
- Explain the basics of microbial metabolism including photosynthesis, respiration, and fermentation, and the chemical reactions involved
- Balance simple chemical reactions
- Explain the importance of oxygen demand in assessing wastewaters
- Calculate theoretical, ultimate, and 5-day BOD
- Know the basic unit processes involved in the conventional treatment of domestic sewage
- Discuss the purpose and processes involved in preliminary wastewater treatment
- Design a grit chamber based on design parameters
- Describe variations in wastewater flow rates
- Calculate the required volume of an equalization tank
- Understand the purpose and methods of primary treatment for wastewater
- Calculate the size of a primary clarifier based on design parameters
- Understand the purpose and methods of secondary treatment for wastewater
- Explain the differences between suspended growth and attached growth activated sludge systems
- Identify and apply various design parameters used in sizing secondary treatment process units
- Understand the purpose and methods of secondary treatment for wastewater
- Discuss the differences between suspended growth and attached growth secondary treatment systems
- Identify and apply various design parameters such as SRT and F/M ratio used in sizing activated sludge aeration tanks
- Identify modifications to conventional activated sludge systems
- Describe the settling characteristics of activated sludge
- Identify and describe several attached growth systems
- Identify the major methods of supplying oxygen to aerobic treatment of wastewater
- Understand the purpose of tertiary treatment for wastewater
- Understand the differences in the disinfection of wastewater compared to the disinfection of drinking water
- Explain the purpose and importance of treating sludges produced in wastewater treatment, and the methods employed to stabilize, dewater, dispose, and reuse wastewater treatment solids
- Define solid waste in terms of sources and waste classifications
- Describe strategies to reduce quantities of solid waste
- Understand and describe several engineered options to manage solid waste
- Understand the health risks associated with the burning of solid waste
- Describe US and Canadian Air Quality Standards and Objectives
- Discuss engineered air quality control technologies commonly incorporated in solid waste incinerator facilities

<table>
<thead>
<tr>
<th>Weight &amp; Date(s) of Assessments:</th>
<th>Weight</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments:</td>
<td>15%</td>
<td>Dates: See page 4.</td>
</tr>
<tr>
<td>Labs</td>
<td>15%</td>
<td>Dates: TBA</td>
</tr>
<tr>
<td>Mid-term</td>
<td>20%</td>
<td>Date: 2/22/16</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50%</td>
<td>Date: TBA</td>
</tr>
</tbody>
</table>
ASSIGNMENTS

A total of 6 assignments (each 2.5% of the course grade) will be distributed throughout the term via the CIVE 310 Course Space site. The assignment problems will be predominantly hand calculations. **Assignments are to be completed and submitted independently.** Only some of the problems will be marked. Solutions for all assignment problems will be posted on the webpage after the assignment is collected, so that you can check your own work. Mid-term and Final Exam questions will be similar to the assignment problems. Assignment hardcopy submissions are to be made to the CIVE 310 dropbox (location TBA) or directly to the Instructor prior to lecture on the due date.

<table>
<thead>
<tr>
<th>Assignment #</th>
<th>Topics</th>
<th>Start</th>
<th>Due (8:30 am)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sustainability concepts, professional</td>
<td>1/5/16</td>
<td>1/12/16</td>
</tr>
<tr>
<td></td>
<td>communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Units and environmental measurements</td>
<td>1/19/16</td>
<td>1/26/16</td>
</tr>
<tr>
<td>3</td>
<td>Environmental chemistry</td>
<td>1/26/16</td>
<td>2/2/16</td>
</tr>
<tr>
<td>4</td>
<td>Physical parameters</td>
<td>2/23/16</td>
<td>3/2/16</td>
</tr>
<tr>
<td>5</td>
<td>Water quality/water treatment/env.</td>
<td>3/9/16</td>
<td>3/16/16</td>
</tr>
<tr>
<td></td>
<td>microbiology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>BOD/water/wastewater treatment</td>
<td>3/23/16</td>
<td>3/30/16</td>
</tr>
</tbody>
</table>

LABORATORIES

There will be a total of 4 labs (Determination of Solids, Jar Test, 5-Day Biochemical Oxygen Demand, and Chlorine Demand), each worth equal marks (3.75 marks each). Labs will be conducted in groups (the number of people per group will vary depend on the lab). The lab groups will be assigned at the beginning of the term.

Each group will have to write up one lab report. Lab reports are due 2 weeks after the lab session (i.e. at the beginning of the next lab period). Students must have a lab coat, lab glasses, the lab manual, and a blank exercise book in order to participate in the labs. If the students do not have these, they will not be allowed in the lab, and will receive a mark of zero for that lab. All of these items except the lab manual may be purchased at the University bookstore. The lab manual will be posted online, and may be printed from there. All labs will take place in the Ian Stewart Complex (Room ISC 371).

Lab Report Format: Written lab reports must contain the following:
1. Title Page: Title of Experiment Course Name and Number Names of Group Members Date the Lab was Completed Date the Lab was Submitted
2. Purpose: State the main objective(s) of the experiment.
3. Apparatus: List all of the materials used to complete the lab (i.e. glassware, reagents, equipment).
4. Methods: Write all of the steps completed to perform the experiment.
5. Results: Present clearly any results, tables, graphs and calculations from the lab.
6. Discussion: Discuss your results and what you learned from the experiment. Did you get the results you expected, and did you meet your original objectives? Why or Why not? Include any background information (theory) that can support your discussion.
7. Conclusions: Sum up in a single paragraph what happened in the lab, whether the objective was met, and why the findings are important.
8. References: Include any references that may have been used.
NOTES:

Failure to complete all laboratory requirements will result in a grade of N being awarded for the course. Failure to pass the final exam will result in a failing grade for the course. Midterm and Final are closed book examinations. Tables and a formula sheet will be provided together with the questions. If anyone misses the midterm exam for an acceptable reason (as stated in the University Calendar such as sickness with medical report), this component will be transferred to the final exam in calculating the final grade.

Late Assignments: No late assignments will be accepted unless prior arrangements have been made with the instructor at least 48 hours before the assignment due date.

Coursework Mark Appeals: All marks must be appealed within 7 days of the mark being posted.

Attendance: We expect students attend all lectures and labs. It is entirely the students’ responsibility to recover any information or announcements presented in lectures from which they were absent.

Electronic Devices: No unauthorized audio or video recording of lectures is permitted. Calculators are only permitted for examinations and tests if explicitly authorized and the type of calculator permitted may be restricted. No other electronic devices (e.g. smart phones) may be used during examinations or tests unless explicitly authorized.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

COURSE LECTURE NOTES

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

There will be no supplemental examination for this course.
GENERAL INFORMATION
Note to Students:
Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

"Attendance"

Students are expected to attend all classes in which they are enrolled. An academic unit may require a student to withdraw from a course if the student is registered in another course that occurs at the same time....

An instructor may refuse a student admission to a lecture, laboratory, online course discussion or learning activity, tutorial or other learning activity set out in the course outline because of lateness, misconduct, inattention or failure to meet the responsibilities of the course set out in the course outline. Students who neglect their academic work may be assigned a final grade of N or debarred from final examinations.

Students who do not attend classes must not assume that they have been dropped from a course by an academic unit or an instructor. Courses that are not formally dropped will be given a failing grade, students may be required to withdraw and will be required to pay the tuition fee for the course.” UVic Calendar, (2015) http://web.uvic.ca/calendar2015-09/FACS/UnIn/UARe/Atte.html

Accommodation of Religious Observance (AC1210) http://web.uvic.ca/calendar2015-09/GI/GUPo.html

Discrimination and Harassment Policy (GV0205) http://web.uvic.ca/calendar2015-09/GI/GUPo.html

Faculty of Engineering, University of Victoria Standards for Professional Behaviour

“It is the responsibility of all members of the Faculty of Engineering, students, staff and faculty, to adhere to and promote standards of professional behaviour that support an effective learning environment that prepares graduates for careers as professionals....”

You are advised to read the Faculty of Engineering document Standards for Professional Behaviour which contains important information regarding conduct in courses, labs, and in the general use of facilities. http://www.uvic.ca/engineering/current/undergrad/index.php #section0-23

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the Undergraduate Calendar for the UVic policy on academic integrity.

Policy on Academic Integrity http://web.uvic.ca/calendar2015-09/FACS/UnIn/UARe/PoAcI.html

Course Schedule

<table>
<thead>
<tr>
<th>Lectures</th>
<th>Topics</th>
<th>Date(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>1/4/16</td>
</tr>
<tr>
<td>2</td>
<td>Sustainability concepts, professional communication</td>
<td>1/5/16</td>
</tr>
<tr>
<td>3 - 4</td>
<td>Units and environmental measurements</td>
<td>1/11/16 – 1/12/16</td>
</tr>
<tr>
<td>5 - 8</td>
<td>Environmental chemistry</td>
<td>1/18/16 –1/26/16</td>
</tr>
<tr>
<td>9 - 10</td>
<td>Physical parameters</td>
<td>2/1/16 – 2/2/16</td>
</tr>
<tr>
<td>11 - 13</td>
<td>Water quality/water treatment</td>
<td>2/15/16 – 2/23/16</td>
</tr>
<tr>
<td>-</td>
<td>MID TERM EXAM</td>
<td>2/22/16</td>
</tr>
<tr>
<td>14</td>
<td>Environmental microbiology</td>
<td>2/29/16</td>
</tr>
<tr>
<td>15</td>
<td>Biochemical oxygen demand</td>
<td>3/1/16</td>
</tr>
<tr>
<td>16 - 21</td>
<td>Water/wastewater treatment</td>
<td>3/7/16 – 3/22/16</td>
</tr>
<tr>
<td>22</td>
<td>Solid waste</td>
<td>3/29/16</td>
</tr>
<tr>
<td>23</td>
<td>Air quality</td>
<td>4/4/16</td>
</tr>
<tr>
<td>-</td>
<td>FINAL EXAM PERIOD</td>
<td>4/7/16 – 4/22/16</td>
</tr>
</tbody>
</table>