In the course, students will be taught the basic principles of water quality and treatment. The course will introduce the need for proper treatment of domestic water for human consumption and the problems associated with inadequate treatment. The course will also focus on drinking water treatment processes and technologies, ranging from very simple low-tech solutions to larger technologies typically found in North America. Finally, the course will study the identification of drinking water sources with adequate quality and quantity.

**Calendar Copy:**
In the course, students will be taught the basic principles of water quality and treatment with particular focus on developing communities. Specific topics will include drinking water quality guidelines and legislation, identifying drinking water sources with adequate quality and quantity, drinking water treatment technologies and water distribution systems. (0.5 course)

**Prerequisites:**
CEE 2217A/B or CBE 2220A/B

**Antirequisites:**
None

Note: It is the student's responsibility to ensure that all Prerequisite and Corequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the student's responsibility to ensure that they have not taken a course listed as an Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Prerequisite, Corequisite or Antirequisite conditions.

**Contact Hours:**
3 lecture hours/week;
Lectures will be delivered in-person and lecture slides will be posted to the course OWL site. Lectures will be organized into learning modules which students should review on a weekly basis. Class exercises at the end of each module will be used to track participation. Review of lecture material and self-study should take approximately 6 hours per week.

3 laboratory - tutorial hours/week.
Laboratory modules will be delivered in-person. Pre-recorded pre-lab talk and detailed instruction videos will be posted to the course OWL site according to the laboratory schedule outlined below. A 1 hour asynchronous and 2 hours in-person laboratory session will be delivered each week during the scheduled lab hours. The tutorial sessions will be handled over zoom. The laboratory and tutorial sessions will be run alternatively (i.e. one week lab, the second week tutorial). Laboratory schedules are outlined below. Attending the lab is mandatory. Tutorials will be online, attending tutorials are not mandatory but students seeking assistance with the bi-weekly labs/assignments or clarification on lecture material are strongly encouraged to attend. The link to the Zoom tutorial sessions will be posted to OWL.
Instructor:
Dr. Martha Dagnew, CMLP 1302
mdagnew@uwo.ca
Office hours: via Zoom (link will be posted on course OWL site)
Date and time: 9:30 to 10:30 am Friday

Administrative Assistant: Sandra McKay (smckay@uwo.ca)

Textbook:

Other References:
Reynolds, T. and Richards, P. Unit Operations and Processes in Environmental Engineering, Cengage Learning
Droste, R.L., Theory and Practice of Water and Wastewater Treatment, J. Wiley & Sons, 2nd edition

Units:
Both SI and FPS unit systems may be used in lectures, tutorials and examinations.

Specific Learning Objectives:
The lectures and tutorial assignments will prepare students to do the following [Graduate attribute Indicator].

1. Drinking water quality [IESE 1, IESE 3]
   a. Recognize water borne diseases and the effects on human health
   b. Understand anthropogenic sources of drinking water contamination and the effects on human health
   c. Identify other sources of drinking water contamination and the effects on human health
   d. Recognize drinking water standards & legislation in North America and the rest of the world

2. Identifying drinking water sources with adequate quality and quantity [IESE 2]
   a. Understand hydrological cycle
   b. Identify groundwater and surface water sources –quantity and quality and well hydraulics
   c. Design distribution systems meeting water quality and quantity demands

3. Design drinking water treatment processes and technologies involving [PA2, D3 and D4]:
   a. Reactor flow fundamentals,
   b. Screening technologies
   c. Colloidal stability, coagulation and mixing principles
   d. Flocculation/sedimentation processes
   e. Sand filtration and other advanced processes such as membrane filtration
   f. Chlorination and other advanced disinfection processes such as UV and oxidation
   g. Adsorption

The instructor may expand or revise material presented in the course as appropriate.

General Learning Objectives:
E=Evaluate, T=Teach, I=Introduce; (I) = Introduction, (D) = Developing, (A) = Advanced level

<table>
<thead>
<tr>
<th>Knowledge Base</th>
<th>Engineering Tools</th>
<th>Impact on Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Analysis</td>
<td>E Team Work</td>
<td>Ethics and Equity</td>
</tr>
<tr>
<td>Investigation</td>
<td>Communication</td>
<td>Economics and Project Management</td>
</tr>
<tr>
<td>Design</td>
<td>E Professionalism</td>
<td>Life-Long Learning</td>
</tr>
</tbody>
</table>

The impact of engineering on society and the environment [IESE 1,2,3] and the ability to analyse problem and design solutions for water treatment processes [PA2, D3, D4] are evaluated at the “advanced” level.
Evaluation:

The final mark will be determined as follows:

- Participation: 10%
- Weekly lab reports and bi-weekly assignments: 25%
- Midterm exam: 15%
- Final Examination: 50%
- Total: 100%

1. Quizzes and Examinations:

A two-hour midterm exam will be held during a tutorial hour. The midterm exam date is tentatively scheduled for Friday, October 23. The exam will be conducted via the OWL platform.

A three-hour written final examination will be held during the regular examination period. The written examination will be followed by a 15-minute oral examination in which the written examination will be reviewed and discussed with the student.

2. Bi-weekly Assignments:

Assignments will be given on a bi-weekly basis. Assignments are to be submitted prior to the due date to OWL. Late assignments will be assessed a penalty of 10% per day, to a maximum of 4 days, after which they will receive a mark of zero. Extensions are to be negotiated with the course instructor, not the teaching assistants.

3. Laboratories:

Labs will be presented through pre-recorded video and students are required to complete a laboratory report based on provided data. Below is a tentative laboratory schedule (subject to change):

<table>
<thead>
<tr>
<th>Week of</th>
<th>Laboratory session</th>
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</thead>
<tbody>
<tr>
<td>September 17</td>
<td>An introduction to lab safety and expectations (Intro)</td>
</tr>
<tr>
<td>September 24</td>
<td>Basic water tests: pH, alkalinity, acidity, hardness, color and turbidity (Lab 1)</td>
</tr>
<tr>
<td>October 01</td>
<td>Biological oxygen demand, total suspended solids and nitrate (Lab 2)</td>
</tr>
<tr>
<td>October 15</td>
<td>Coagulation and flocculation using Jar Test through turbidity and color measurement (Lab 3)</td>
</tr>
<tr>
<td>October 29</td>
<td>Coliform enumeration (Lab 4)</td>
</tr>
<tr>
<td>November 19</td>
<td>Building multi-media filter</td>
</tr>
<tr>
<td>November 26</td>
<td>Multi-media filter performance characterization based on total solids, turbidity and particle size distribution measurement (Lab 5)</td>
</tr>
<tr>
<td>December 03</td>
<td>Chlorine Demand for raw and filtered water (Lab 6)</td>
</tr>
</tbody>
</table>

4. Participation:

Class and lab participation will be assessed through class exercise and iclicker online submissions, respectively. Submissions related to participation should be made during lab/lecture hours.
Use of English:
In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Accessibility:
Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Attendance:
Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Cheating:
University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning. For more information on scholastic offenses, please see:
http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

Plagiarism Checking:
The University of Western Ontario uses software for plagiarism checking. Students are required to submit their Laboratory Reports in electronic form to Turnitin.com for plagiarism checking.

Conduct:
Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others. On the premises of the University or at a University-sponsored program, students must abide by the Student Code of Conduct: http://www.uwo.ca/univsec/board/code.pdf

Sickness and Other Problems:
Students should immediately consult with the Instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal. For more information concerning medical accommodations, please see:
http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf

Notice:
Students are responsible for regularly checking their email, course website (https://owl.uwo.ca) and notices posted outside the Civil and Environmental Engineering Department Office

Consultation:
Students are encouraged to discuss problems with their teaching assistant and/or instructor in tutorial sessions. Office hours will be arranged for the students to see the instructor and teaching assistants. Other individual consultation can be arranged by appointment with the appropriate instructor.

Course breakdown:
Engineering Science = 75% = 42.53 AU’s; Engineering design = 25% = 14.18 AU’s
The document “INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMINT ASSIGNMENTS AS SCHEDULED” is part of this course outline.
INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED

IF, ON MEDICAL OR COMPASSIONATE GROUNDS, YOU ARE UNABLE TO WRITE TERM TESTS OR FINAL EXAMINATIONS OR COMPLETE COURSE WORK BY THE DUE DATE, YOU SHOULD FOLLOW THE INSTRUCTIONS LISTED BELOW. YOU SHOULD UNDERSTAND THAT ACADEMIC RELIEF WILL NOT BE GRANTED AUTOMATICALLY ON REQUEST. YOU MUST DEMONSTRATE TO YOUR DEPARTMENT (OR THE UNDERGRADUATE SERVICES OFFICE) THAT THERE ARE COMPELLING MEDICAL OR COMPASSIONATE GROUNDS THAT CAN BE DOCUMENTED BEFORE ACADEMIC RELIEF WILL BE CONSIDERED. DIFFERENT REGULATIONS APPLY TO TERM TESTS, FINAL EXAMINATIONS AND LATE ASSIGNMENTS. PLEASE READ THE INSTRUCTIONS CAREFULLY. (SEE THE 2017 UWAO ACADEMIC CALENDAR).

A. GENERAL REGULATIONS & PROCEDURES

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.

2. If you are an upper year student and you are missing a test/assignment/lab or exam that is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097. Otherwise, you will report to your department office to request relief.

3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.

4. Documentation must be provided as soon as possible. If no one is available in your Department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.

5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

B. TERM TESTS

1. If you are in first year and you are unable to write a term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.

2. If you are an upper year student and you are unable to write a term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief. Otherwise, you will report to your department office to request relief.

3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).

4. Discuss with the instructor if and when the test can be rescheduled. N.B. The approval of the Chair or the Undergraduate Services Office is required when rescheduling term tests.

C. FINAL EXAMINATIONS

1. If you are unable to write a final examination, contact the Undergraduate Services Office PRIOR TO THE SCHEDULED EXAMINATION TIME to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.

2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, sleeping in, misreading timetable and travel arrangements.

3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department and the Associate Dean and in order to apply you must sign a “Recommendation for a Special Examination Form” available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

N.B. It is the student’s responsibility to check the date, time and location of the Special Examination.

D. LATE ASSIGNMENTS

1. Advise the instructor if you are having problems completing the assignment on time (prior to the due date of the assignment).

2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).

3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Associate Dean if you are in first year) is not required if assignments will be completed prior to the last day of classes.

4. i) Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean. Documentation is mandatory.

ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean.
E. SHORT ABSENCES

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

F. EXTENDED ABSENCES

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You may want to seek advice from the academic counsellor in your Department or Ms. Karen Murray in the Undergraduate Services Office, if you are in first year.

G. DOCUMENTATION

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, you must provide the doctor with a Student Medical Certificate to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor's notes will not be accepted; only the Student Medical Certificate will be accepted.

In Case of Serious Illness of a Family Member: Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

In Case of a Death: Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

For Other Extenuating Circumstances: If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).

2. You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.

3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your academic counsellor.

Calendar References: Check these regulations in your 2017 Western Academic Calendar available at www.westerncalendar.uwo.ca.
Absences Due to Illness: http://westerncalendar.uwo.ca/2017/pg117.html
Academic Accommodations for Students with Disabilities: http://westerncalendar.uwo.ca/2017/pg118.html
Academic Accommodations for Religious or Holy Days: http://westerncalendar.uwo.ca/2017/pg119.html
Course Withdrawals: http://westerncalendar.uwo.ca/2017/pg157.html
Examinations: http://westerncalendar.uwo.ca/2017/pg129.html
Scheduling of Term Assignments: http://westerncalendar.uwo.ca/2017/pg135.html
Scholastic Offences: http://www.westerncalendar.uwo.ca/2017/pg135.html
Student Medical Certificate: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf
Engineering Academic Regulations: http://www.westerncalendar.uwo.ca/2017/pg1442.html

Note: These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University. Drop Deadlines:

First term half course (i.e. “A” or “F”): November 12, 2018
Second term half or second term full course (i.e. “B” or “G”): March 7, 2019

Full courses and full-year half courses (i.e. “E”, “Y” or no suffix): November 30, 2018

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).