ENGG*3590 WATER QUALITY
FALL 2017

School of Engineering

(Revision 0: July 31, 2017)

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1 INSTRUCTIONAL SUPPORT

1.1 Instructor

Instructor: Hongde Zhou, Ph.D., P.Eng.
Office: RICH 3511, ext. 56690
Email: hzhou@uoguelph.ca
Office hours: Wednesday 1:00pm to 2:00pm or by appointment

1.2 Lab Technician

Technician: Joanne Ryks
Office: THRN 1114, ext. 54087

1.3 Teaching Assistants

GTA	Email	Office Hours	Room
Edwin Castilla Rodriguez	ecastill@uoguelph.ca	Mon 1:30pm to 2:30pm	THRN 2109
Beraki Mehari	bmehari@uoguelph.ca	Thur 1:30pm to 2:30pm	THRN 3106
Yu Hou	yhou05@uoguelph.ca	No	THRN 2109

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2 LEARNING RESOURCES

2.1 Course Website

Course materials, announcements, and grades will be regularly posted to the ENGG*3590 Courselink site. You are responsible for checking the site regularly.

2.2 Recommended Resources

Tchobanoglous, G. and Schroeder, E. (1985). Water Quality: Characteristics, Modeling and Modification. Addison-Wesley, Reading, MA, 768p.

2.3 Other Resources

Benjamin, M.M. (2014). Water Chemistry. 2nd edition, Waveland Press, Inc., Long Grove, IL.

Davis, M.L. (2011). Water and Wastewater Engineering: Design Principles and Practice. McGraw Hill, Inc., New York, NY.

Droste, R.L. (1997). Theory and Practice of Water and Wastewater Treatment. John Wiley & Sons, New York, NY.

Jensen, J.N. (2003). A Problem Solving Approach to Aquatic Chemistry. Wiley Publisher, New York, NY.

Reynolds, T.D. and Richards, P.A. (1996). Unit Operations and Processes in Environmental Engineering, 2nd Edition, PWS Publishing Co. Boston, MA.

Sawyer, C.N., McCarty, P.L. and Gene F. Parkin, G.F. (2003). Chemistry for Environmental Engineering and Science. 5th edition, McGraw Hill, Inc., New York, NY.

American Public Health Association, American Water Works Association and Water Environment Federation, (2017). Standard Methods for the Examination of Water and Wastewater, 23rd Edition.

Stumm, W. and Morgan, J.J. (1996). Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters. 3rd edition, John Wiley, New York, NY.

Viessman, W. Jr., Hammer, M.J., Perez, E.M. and Chadik, P.A. (2009). Water Supply and Pollution Control. Pearson Prentice Hall, Upper Saddle River, NJ.

2.4 Additional Resources

Lecture Information: All the lecture notes will be posted on the Courselink (week #1-#12). Please note that the posted lecture notes will include only a portion of information presented during the class. Other information will be provided during the lectures through examples and problems.

Labs and Assignments: The information for all the labs and assignments will be posted on the Courselink. Download them according to the schedule given in this handout.

Miscellaneous Information: Other information related to the course will also be posted on the Courselink OR announced during the lectures.

2.5 Communication & Email Policy

Please use the lectures, labs and tutorials as your main opportunities to ask questions about the course. Major announcements will be posted to the course website. It is your responsibility to check the course website regularly. As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its student.

3 ASSESSMENT

3.1 Dates and Distribution

Lab Reports: 15%.

The procedures for each laboratory are outlined in the Lab Manual, including safety issues. Please read the appropriate sections prior to the lab to ensure that the lab flows smoothly. Tentative lab schedule is listed below:

Week 1: lab orientation and safety
Week 2 to 3: Biological chemical demand
Week 4: Colilforms (TC and FC)
Week 5: no lab due to Thanks-Giving and fall study break
Week 6 and 7: Coagulation/Flocculation (jar tests)
Week 8 and 9: Type 2 settling
Week 10: Chlorine demand.

The students will work in pairs at your choice. Each pair of students will prepare individually written lab reports using the appropriate data set. The lab reports are due one week after the experiments are completed. Only electronic copies are acceptable.

Assignments: 0%

Tentatively, a total of seven assignments will be provided through the semester. No submission of these assignments is required as their solutions will be posted on the Courselink. You are also advised to ask any questions related to the assignments, labs and other course work during the weekly seminars and GTAs' office hours.

Midterms (2): 35%

October 11, 8:30AM to 9:20AM, MACS 209
November 15, 8:30AM to 9:20AM, MACS 209

Two midterms will be used to evaluate the progresses of your learning via the lectures, seminars, labs and assignments. Thus, you are strongly encouraged to complete all the course work independently and timely.

Final Exam: 50%

Wednesday December 6, 17:00PM - 19:00PM, Room: TBD on Webadvisor

3.2 Course Grading Policies

Missed Midterm/Design Reports/Assignments: If you miss the midterm/lab reports due to grounds for granting academic consideration or religious accommodation, the weight of the missed course work will be added to the final exam. There will be no makeup midterm test/lab reports/assignments.

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: You must achieve a passing grade of 50% or greater on both labs and midterms in order to pass the course. If you fail to do so, your final grade will be equal to that failing percentage.

Missed Midterm/Design Reports: If you miss the midterm/lab reports due to grounds for granting academic consideration or religious accommodation, the weight of the missed course work will be added to the final exam. There will be no makeup midterm test/lab reports.

Lab Work: You must attend and complete all laboratories. If you miss a laboratory due to the grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistants/lab technician to attend an alternate lab (same lab conducted on an alternate date).

Late Lab Reports: Late submission of the lab reports will be devalued by 50% per every day.

Interruption of Lectures/Seminars: No interruption is allowed during lectures/seminars, unless permitted by the instructor. In case such incident occurs, you may be asked to leave from the teaching rooms immediately.

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4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Calendar Description

This course builds on the student's experience in chemistry, biology, physics and fluid mechanics, and provides an engineering perspective on: (i) standard methods of water quality analysis for physical, chemical and biological characteristics of water; (ii) significance and interpretation of analytical results, (iii) modeling of water quality in natural systems and (iv) introduction to engineered water and wastewater treatment systems.

Prerequisite(s): ENGG*2230, ENGG*2560, (1 of BIOL*1040, BIOL*1090, MICR*1020, MICR*2420), STAT*2120

4.2 Course Aims

The goal of this course is to provide the students with the concepts and principles to address the water quality problems they will face in their senior years, during their work terms, and upon graduation. The course will also attempt to introduce the theory and practice in water treatment and system approach to water management.

4.3 Learning Objectives

On successful completion of this course, you will be able to:

1. understand and characterize important physical, chemical and biological water quality parameters and their implication in water quality issues,
2. perform routine water and wastewater analyses and make appropriate interpretations of water quality data,
3. perform preliminary design of conventional water treatment plants,
4. use oxygen sag models to model water quality in the river,

5. develop investigation skills through laboratory work and communicate findings of laboratory tests to wide audience, and
6. Understand and communicate the relationship between various water quality parameters and ecosystem and public health

4.4 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1, 2, 3	Midterms, Final exam
2. Problem Analysis	1, 3, 4	Midterms, Final exam
3. Investigation	2, 5	Lab reports
4. Design	1, 3, 4	Lab reports, Final exam
5. Use of Engineering Tools		
6. Communication	6	
7. Individual and Teamwork	1	Lab reports
8. Professionalism		-
9. Impact of Engineering on Society and the Environment	1, 2, 3	Midterms, Final exam
10. Ethics and Equity	-	-
11. Economics & Project Management	-	-
12. Life-Long Learning	-	-

4.5 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink/D2L but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.6 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and tutorials. Students, especially those having difficulty with the course contents, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.7 Relationships with other Courses & Labs

Previous Courses:

ENGG*2230: fluid properties (i.e. density, viscosity, etc.), Bernoulli and Momentum equations, pipe flow and open channel flow.

ENGG*2560: mass balance analysis for steady state and unsteady state situations, reactor types including batch, plug-flow and CSTR, analysis under both equilibrium and non-equilibrium conditions.

STAT*2120: tools and methods for data analysis, the basic concepts for measurement errors. .

BIOL*1040, BIOL*1090, MICR*1020 and MICR*2420 (one of them): diversity and roles of microorganisms in the environment, laboratory methods to detect and quantify the microorganisms.

Follow-on Courses:

ENGG*4720 and 4760: Principles and practice to design and operate a variety of physical, chemical and biological systems to treat drinking water, municipal wastewater and industrial wastewater.

ENGG*4510: Knowledge and approaches to perform environmental impact and health risk assessment.

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5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Type	Section	Time	Location
Lectures:			
Mon, Wed, Fri.	All	8:30 AM – 9:20AM	MACS 209
Labs:			
Mon	11/12/21/22	01:30AM - 14:20PM	
Tue	31/32/41/42	14:30PM - 17:20PM	THRN 1116
Thur	51/52	14:30PM - 17:20PM	
Seminars:			
Tue	12/22/32/42/52	05:30AM - 6:50PM	MCKN 225
Wed	11/21/31/41/51	05:30AM - 6:50PM	MCKN 225

5.2 Lecture Schedule (Tentatively)

Topics	Week	Chapter
I - Introduction, Sources and Uses of Water and Wastewater	1	1
II. Basic Concepts in Water Chemistry ▪ Molecular structure of water and behaviours of solutes ▪ Concentration and activity expression of solutes ▪ Chemical reactions and equilibrium ▪ pC-pH diagram and carbonate system ▪ Precipitation and complexation ▪ Redox chemistry	2	Appendix E 2.1, 2.2, 2.5 Notes
III - Physical, Chemical and Biological Characteristics of Water ▪ turbidity ▪ solids - sludge volume ▪ taste, odour and temperature ▪ pH, acidity, alkalinity and hardness ▪ ThOD, COD and BOD ▪ nutrients - eutrophication ▪ synthetic organics ▪ gases ▪ microorganisms - bacteria, viruses, pathogens, coliform, *Giardia*, *Cryptosporidium*	3 to 6	2 & 3
IV - Analysis and Sampling Methods (*water and solid matrices)* ▪ physical, chemical and biological ▪ grab, composite, continuous and remote ▪ preservation ▪ gravimetric (solids), volumetric (titration), photometric (colour, nitrates, iron), electrometric (pH, DO, temperature), culturing (coliform, plate counts) ▪ overview of high tech (GC, GC-MS, ICP, HPLC)	7	2.3, 4
V - Simple River model (oxygen sag)	8 to 9	8.1, 8.2, 9.1
VI – Introduction to Water and Wastewater Treatment ▪ history ▪ introduction to physiochemical treatment – coagulation, flocculation, sedimentation, filtration, aeration, disinfection ▪ introduction to biological treatment – suspended growth processes, attached growth processes, anaerobic digestion, sludge processing	10 to 12	11, 12.1, 12.4 to 12.11, 13.1 to 13.4, 14.1 to 4, 14.6 to 14.8, 14.11
Final Exam: December 6, 7:00pm to 9:00pm		

5.3 Other Important Dates

Thursday, September 7: first class
Monday, October 9: Thanks-Giving holiday
Tuesday, October 10: fall study break day
Friday, November 3: drop date – 40th class
Wednesday, November 29: last day for regularly scheduled classes
Thursday, November 30: classes rescheduled from Tuesday, October 10
Friday, December 1: classes rescheduled from Monday, October 9

Please refer to University Calendar 2017-2018 for other important dates.

6 LAB SAFETY

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in technical tours you are responsible for taking all reasonable safety precautions and following the safety rules you are encountering. In addition, you are responsible for reporting all safety issues to the lab supervisor, GTA or faculty responsible.

7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at: http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at: http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

8 ACCESSIBILITY:

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible

For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: http://www.csd.uoguelph.ca/csd/