ENGG*4760 WATER AND WASTEWATER TREATMENT DESIGN

Winter 2017

UNIVERSITY of GUELPH

School of Engineering

(Revision 0: December 6, 2016)

1 INSTRUCTIONAL SUPPORT

1.1 Instructor

Instructor: Hongde Zhou, Ph.D., P.Eng.
Office: RICH 3511, ext. 56990
Email: hzhou@uoguelph.ca
Office hours: Monday 11:00am to 12:00pm or by appointment

1.2 Lab Technician

Not applicable

1.3 Teaching Assistants

GTA	Email	Phone	Office Hours
Edwin Castilla Rodriguez	ecastill@uoguelph.ca		Wednesday 11:30an to 12:20pm

2 LEARNING RESOURCES

2.1 Course Website

Course material, announcements, and grades will be regularly posted to the ENGG*4760 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources

Metcalf & Eddy, Inc. (2014). Wastewater Engineering: Treatment and Resource Recovery, 5th edition, McGraw Hill, Inc., New York, NY, 2018p.

2.3 Recommended Resources

REFERENCE BOOKS

Davis, M.L. (2010). 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, 800p.

Grady, C.P.L., Jr., Gaigger, G.T. and Lim, H.C. (1999). Biological Wastewater Treatment. 2nd edition, Marcel Dekker, New York, NY, 1076p.

Henze, M., van Loosdrecht M.C.M., Ekama, G.A., Brdjanovic, D. 2008. Biological Wastewater Treatment: Principles, Modelling and Design. IWA Publishing, London, UK, 511p.

Metcalf & Eddy, Inc. (2006). Water Reuse: Issues, Technologies and Applications, McGraw Hill, Inc., New York, NY, 1570p.

Qasim, S.R. (1999). WastewaterTtreatment Plants: Planning, Design, and Operation. Technomic Pub. Co, Lancaster, PA, 1107p.

Recommended Standards for Wastewater Facilities. 1997 Edition, The Great Lakes – Upper Mississippi River Board of State and Provincial Public health and Environmental Managers, Albany, NY.

Reynolds, T.D. and Richards, P.A. (1996). Unit Operations and Processes in Environmental Engineering, 2nd Edition, PWS Publishing Co. Boston, MA, 798p.

Viessman, W. Jr., Hammer, M.J., Perez, E.M. and Chadik, P.A. (2009). Water Supply and Pollution Control. Pearson Prentice Hall,,U pper Saddle River, NJ, 843p.

WEF and ASCE, (1998). Design of Municipal Wastewater Treatment Plants, Vol. 1, 2 and 3, 4th Edition, Alexandria, VA.

WEF and IWA, (2003). Wastewater Treatment Plant Design. Edited by A. Vesilind, Water Environment Federation, Alexandria, VA.

REFEREED JOURNALS

Water Research
Water Environment Research
American Water Works Association Journal
Journal of Environmental Engineering, ASCE
Environmental Science & Technology

2.4 Additional Resources

Lecture Information: All the lecture notes are posted on the Courselink throughout the semester.

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

Exams: sample exams from previous years are posted on the Courselink.

Miscellaneous Information: Other information related to the course is also posted on the Courselink.

2.5 Communication & Email Policy

Please use lectures and lab help sessions as your main opportunity 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.

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3 ASSESSMENT

3.1 Dates and Distribution

Projects: 15%

Due date: Wednesday March 15, in class
Note: You are allowed to submit either the hardcopies (preferred) or electronic copies on Courselink dropbox.

Assignments (5): 15% (3% each)

All the assignments must be submitted prior to the lectures on the dates specified.

Midterm: 25%

Friday March 3, 3:30PM - 5:20PM, MCKN 234

Final Exam: 35%

Thursday April 20, 7:00 PM to 9:00PM, ROOM: TBD

3.2 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

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 on the project design component 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/Assignments: If you miss the midterm/design reports/assignments 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/Project Reports/Assignments.

Project Reports: The projects will be completed in group. Maximum group size is four students. Some groups of three may be permitted depending on the final numbers in the class. You may choose the group members, but the members of your group for the second project should be no more than two from those for the first project.

Each project report must meet the requirements and formats specified in the course handout in order to achieve the perceived course objectives. The report should be technically sound, CLEARLY readable, and concise. Don't use your spare time to create a huge report!

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

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4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Calendar Description

Application of design principles for a variety of water purification systems, including drinking water, municipal wastewater, industrial wastewater and agricultural wastewater. This involves the design of physical, chemical and biological unit operations, and evaluating the optimum combination to satisfy the given design constraints and criteria. The optimum designs integrate engineering science, basic science, economics, and occupational health and safety for the workers and the public.

Prerequisite(s): ENGG*3590

4.2 Course Aims

The goal of this course is to provide the students with the theories and practices for the planning, design and operation of commonly used wastewater treatment facilities. Emphasis will be placed on integrating individual unit operations and processes to achieve multiple treatment objectives while satisfying the economic, environmental and societal constraints.

4.3 Learning Objectives

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

1. properly identify the critical issues and challenges in planning, design and operation of modern wastewater treatment facilities to meet not only current but also anticipated regulatory requirements,
2. develop reasonable working knowledge and hands-on experiences that can be used to devise and design the efficient, cost-effective treatment and water reuse systems, and

3. gain the independent learning skills and enhance your ability to work effectively in teams through problem based learning format.

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	Projects, Assignments, Exams
2. Problem Analysis	1, 2	Projects, Assignments, Exams
3. Investigation	1, 2	Projects, Assignments
4. Design	1, 2	Projects
5. Use of Engineering Tools	1, 2	Projects, Assignments
6. Communication	1, 2, 3	Projects
7. Individual and Teamwork	3	Projects
8. Professionalism		
9. Impact of Engineering on Society and the Environment		Projects
10. Ethics and Equity	-	-
11. Environment, Society, Business, & Project Management	1, 2, 3	Projects, Assignments
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 content, 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*2560: mass balance analysis for steady state and unsteady state situations, reactor types and analysis, reaction equilibrium and kinetics

ENGG*31X: some design tools, writing and public speaking techniques, codes, safety issues, environmental assessment and professional management

ENGG*3590: water quality, basic theories of physical, chemical and biological treatment processes

Follow-on Courses:

None

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5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Lectures:	**Section**	**Time**	**Location**
Monday		9:30am – 10:20am	MCKN 224
Wednesday		9:30am – 10:20am	MCKN 224
Friday		9:30am – 10:20am	MCKN 224
Labs:			
Wednesday	0101	3:30pm – 5:20pm	MCKN 234
Wednesday	0102	3:30pm – 5:20pm	THRN 1116

5.2 Lecture Schedule (tentative)

Weeks	Topics	Chapters	Objectives
0.5	0 – Introduction ▪ Course outline ▪ Overview of wastewater treatment	1.1 to 1.2 1.6	1, 2
0.5	I - Fundamentals of Wastewater Treatment and Reuse ▪ Physical, chemical and biological characteristics ▪ Wastewater sources and flow rates ▪ Treatment objectives ▪ Introduction to wastewater treatment process selection	1.3 to 1.5 2 3 4	1
1.5	II – Wastewater Microbiology ▪ Role and classification of microorganisms ▪ Microbial growth kinetics ▪ Types of biological treatment processes	7.1 to 7.5	1, 2
3.0	III – Suspended Growth Biological Treatment Processes ▪ Activated sludge process analysis and control ▪ Aeration selection and design ▪ Secondary settling	7.6 8.1 to 8.5 8.9 to 8.11 5.10 to 5.11	2, 3
1.0	IV –Biological Nutrient Removal Processes ▪ Nitrogen removal ▪ Phosphorous removal ▪ Combined BNR processes	7.8 to 7.10 7.13 8.6 to 8.8	
March 3	Midterm, 3:30pm to 5:20pm, Room: TBD		
2.0	V – Attached Growth Biological Treatment ▪ Attached growth kinetics and mass transfer limitation ▪ Tricking Filter ▪ Rotating biological contactors ▪ Hybrid processes	7.7 9.1 to 9.4	2, 3
1.5	VI – Anaerobic Processes ▪ Process fundamentals and analysis ▪ Types and design of AD processes	7.14 10.1 to 10.6	2, 3
2.0	VII – Sludge Processing, Utilization and Disposal ▪ Sources, quantities and characteristics ▪ Regulations for the utilization and disposal ▪ Sludge processing ▪ Land application	13.1 to 13.4 13.9 14.1 to 14.2 14.7 to 14.10	1, 2, 3
Final	April 20, 7:00 PM to 9:00PM, ROOM: TBD		

5.3 Lab Schedule and Description

Section:	Time	Location
0101	Wednesday 3:30 – 5:20pm	MCKN 234
0102	Wednesday 3:30 – 5:20pm	THRN 1116

The main purposes of the design labs include: 1) to demonstrate the application of computer simulation packages in designing and optimizing wastewater treatment facilities, 2) to introduce selected regulatory design guidelines and standards currently employed by provincial, federal and international agencies, and 3) to provide more informal discussions among the group students to resolve the issues arising from the design projects and ask the questions about lectures and previously assigned reading materials which require clarification.

5.4 Other Important Dates

Monday, 9 January: First class
Monday, February 20 to Friday, February 24: Spring Break
Friday, 10 March 2015: Fortieth drop date
Friday, 7 April 2015: classes conclude

Please refer to University Calendar 2016-2017 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/