

ENGINEERING 9605: Water and Wastewater Treatment

Instructor Cynthia Coles
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Office Location EN-3004
Office Hours Tues., Thurs. 1:25-2:15 p.m.

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Communication *The best way to reach the professor is through the above MUN email address.*

COURSE DESCRIPTION:

Overviews of global freshwater, centralized and decentralized wastewater treatment, regional water supplies and sources of water; water treatment processes including coagulation and flocculation, sedimentation and settling, granular and membrane filtration, and disinfection; biological wastewater treatment processes focusing on suspended growth processes; design of water and wastewater process components; sludge management will be covered as time permits.

PREREQUISITES: Engineering or Science undergraduate degree

SCHEDULE: LECTURE: Tuesday 12:00 noon -1:15 pm Room: EN 4006
Thursday 12:00 noon – 1:15 pm Room: EN 4006

CREDIT VALUE: 3 credits

RESOURCES:

TEXT BOOK

- *Water and Wastewater Engineering: Design Principles and Practice, 2011, Mackenzie L. Davis, McGraw-Hill.*

REFERENCES

- Cleasby, J.L., 1972, Filtration, in W.J. Weber, Jr., (ed.) *Physicochemical Processes for Water Quality Control*, Wiley-Interscience, New York, pp. 173-174.
- Dominguez-Faus, R., Powers, S.E., Burken, J.G., Alvarez, P.J., 2009, *The water footprint of biofuels: a drink or drive issue*, *Environmental Science & Technology*, 43(9):3005-3010.
- Fane, A.G., Fane, S.A., 2005, *The role of membrane technology in sustainable*

- decentralized wastewater systems, Water Science and Technology, 51(10):317-325.*
- Gikas, P., Tchobanoglous, G., 2007, *The role of satellite and decentralized strategies In water resources Management, Journal of Environmental Management, 90:133-152.*
 - Godfray, H.C.J., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M., Toulmin, C., 2010, *Food Security: The Challenge of Feeding 9 Billion People, Science, 327(5967):812-818.*
 - Libralato, G., Ghirardina, A.V., Avezzu, F., 2012, *To centralise or to decentralise: An overview of the most recent trends in wastewater treatment management, Journal of Environmental Management, 94:61-68.*
 - Pfister, S., Bayer, P., Koehler, A., Hellweg, S., 2011, *Projected water consumption in future global agriculture: Scenarios and related impacts, Science of the Total Environment, 409: 4306-4216.*
 - Pretty, J., Robinson, S., Thomas, S.M., Toulmin, C., 2010, *Food Security: The challenge of feeding 9 billion people, Science, 327:812-818.*
 - Prud'homme, A., 2011, ***The Ripple Effect: The fate of water in the Twenty-First Century***, Scribner, pp. 435.
 - Schwartz, S.A., 2007, *Trends that will affect your future...and nary a drop to drink, Explore, 3(2):95-97.*
 - Tanaka, S.K., Zhu, T., Lund, J.R., Howitt, R.E., Jenkins, M.W., Pulido, M.A., Tauber, M., Ritzema, R.S., Ferreira, I.C., 2006, *Climate warming and water management adaptation for California, Climate Change, 76:361-387.*
 - Troyka, L.Q., Hesse, D., 2005, ***Simon & Schuster Handbook for Writers, Fourth Canadian Edition***, Prentice Hall.
 - *Vital Water Graphics*, 2002, United Nations Environment Program, 2002, <http://www.unep.org/dewa/vitalwater/index.html>.
 - Zekai, S., 2009, *Global warming threat on water resources and environment: a review, Environmental Geology, 57:321-329.*
 - Zimmweman, J.B., Mihelcic, J.R., Smith, J., 2008, *Global stressors on water quality and quantity, Environmental Science & Technology, 42(12):4247-4254.*

MAJOR TOPICS:

- Global water, overview of centralized and decentralized wastewater treatment plants, satellite facilities, global warming effects on water resources, water supply and treatment overview, St. John's regional water supply system, water usage and population forecasting (Ch. 2)
- Groundwater and surface water supplies, water quality, stratification of lakes and rivers
- Coagulation and flocculation, static mixer design, paddle flocculator design (Ch. 3)

- Sedimentation, Type I and Type II settling, settling column tests, sedimentation basin design, high rate tube settlers (Ch. 7)
- Filtration
 - Granular filtration, granular filter headloss, backwashing bed depth, rapid sand filter design, wash trough design (Ch. 8)
 - Membrane filtration, microfiltration and ultrafiltration, membrane flux, fouling and rejection, dead-end and cross-flow operation (Ch. 9)
 - Reverse osmosis and nanofiltration, monovalent and divalent ions removal, carbonate buffer system (Ch. 6 and Ch. 3)
- Disinfection, chlorine, ozone and ultraviolet disinfection (Ch. 10)
- Wastewater treatment overview, secondary treatment by suspended growth biological processes, nitrification, denitrification and phosphorus removal, facultative oxidation ponds, oxidation ditch design, sequencing batch reactor (Ch. 16)

LEARNING OUTCOMES:

Upon successful completion of ENGI 9605, the student will be able to:

1. Identify environmental issues with respect to global freshwater resources and water and wastewater treatment.
2. Identify and use valid sources of information.
3. Source, read and understand academic articles related to water and wastewater management
4. Appreciate the value of lifelong learning as a professional, particularly with respect to ever-evolving environmental and societal issues.
5. Design components of water and wastewater treatment systems.
6. Forecast population growth and estimate water consumption.
7. Discuss groundwater and surface water supplies.
8. Communicate technical information in a clear and effective manner in writing and orally.

ASSESSMENT:

		Approximate Due Dates
Midterm exam 1	20%	Tuesday, February 5 th
Midterm exam 2	20%	Tuesday, March 5 th
Presentation	10%	Thursday, March 14 th
Term Paper	30%	Thursday, March 21 st
Final exam	20%	April 10 th – 19 th

The two midterm exams and the final exam will be open book exams. The only electronic aids that will be permitted on the exams will be scientific calculators. Practice problems, not to be

handed in, will be assigned during the term to prepare students for the exams. The exams will be largely numerical calculations but there could be a small portion related to theory. The electronic PowerPoint presentation files are to be received by the Professor by 12:00 a.m. on March 14th. (A late submission will result in a 5% deduction and every day late beyond that will incur an additional 5% deduction. Missing the first midterm exam will increase the weighting of the second midterm exam and the final exam by 10% each. Missing the second midterm exam will increase the weighting of the final exam by 20%.)

ACADEMIC INTEGRITY AND PROFESSIONAL CONDUCT:

Students are expected to conduct themselves in all aspects of the course at the highest level of academic integrity. Students are encouraged to consult Memorial University's Code of Student Conduct at <http://www.mun.ca/student/conduct>. Students may also consult the Faculty of Engineering and Applied Science Student Code of Conduct which contains the PEG-NL code of ethics and is at <http://www.engr.mun.ca/policies/codeofconduct.php>.

Any student found to commit an academic offence will be dealt with according to the practices as outlined by the School of Graduate Studies. The related calendar information is available at <http://www.mun.ca/regoff/calendar/sectionNo=GRAD-0029>

INCLUSION AND EQUITY:

Students who require physical or academic accommodations are encouraged to speak privately to the instructor so that appropriate arrangements can be made to ensure your full participation in the course. All conversations will remain confidential.

The university experience is enriched by the diversity of viewpoints, values, and backgrounds that each class participant possesses. In order for this course to encourage as much insightful and comprehensive discussion among class participants as possible, there is an expectation that dialogue will be collegial and respectful across disciplinary, cultural, and personal boundaries.

STUDENT ASSISTANCE: Student Affairs and Services offers help and support in a variety of areas, both academic and personal. More information can be found at www.mun.ca/student.

One specific resource provided to students is assistance in writing. Please contact the Writing Centre at <http://www.mun.ca/writingcentre/about/> to find out more.

ADDITIONAL INFORMATION:

Office hours, as show below, are from 1:25 p.m. to 2:15 p.m. on Tuesdays and Thursdays. The other best times to reach the professor in her office are Wednesdays and Fridays after class.

WINTER 2013 SCHEDULE, Dr. C. A. Coles

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9:00					
9:50					
10:00					
10:50					
11:00					
11:50					
12:00	Engi 8713 12:00 noon – 1:15 p.m.	Engi 9605 12:00 noon – 1:15 pm	Engi 8713 12:00 noon – 12:50 p.m.	Engi 9605 12:00 noon – 1:15 pm	Engi 8713 12:00 noon – 1:40 pm
12:50	Tutorial, EN 2050	EN 4006	EN 2050	EN 4006	EN 2050
1:00		Office Hour EN 3004 1:25 pm – 2:15 pm		Office Hour EN 3004 1:25 pm – 2:15 pm	
1:50					
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4:00					
4:50					

Engi 8713: Municipal Engineering
Engi 9605: Water and Wastewater Treatment