

ENGINEERING 9605: Water and Wastewater Treatment

Instructor	Cynthia Coles
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Office Hours	Wed., Fri., 2:10-3:00 p.m.
Website	http://www.engr.mun.ca/~ccoles/
Communication	<i>The best way to reach the professor is by email.</i>

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.

PREREQUISITES: Engineering or Science undergraduate degree

SCHEDULE: LECTURES: Wed., Fri., 10:00 -11:15 am Room: EN 4020

CREDIT VALUE: 3 credits

RESOURCES:

TEXT BOOK

- *Water and Wastewater Engineering: Design Principles and Practice, 2011, Mackenzie L. Davis, McGraw-Hill (e-book of selected chapters at MUN bookstore, hard copy on reserve in QEII Library, TD 345 D36 2011, electronic copy through the QEII Library).*

REFERENCES

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- *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.*

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- 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.
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- 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.
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- *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, 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 reservoirs
- 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 related to water and wastewater resources and treatment.
2. Identify and use valid sources of information.
3. Source, read and understand water and wastewater related academic articles
4. Appreciate the value of lifelong learning 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
Assignments in class	10%	Wed., Jan. 29 th , Wed., Mar. 19 th
Term Paper	25%	Wed., Feb. 5 th
Midterm exam 1	15%	Wed., Feb. 12 th
Presentation	10%	Wed., Feb. 26 th
Midterm exam 2	15%	Wed., Mar. 12 ^h
Final exam	25%	April 9 th – 19 th

Midterm and the final exams will be open book with scientific calculators being the only permitted electronic aids. Practice problems will help students prepare for exams. The exams will contain mostly numerical calculations but could have a small theoretical component. The electronic PowerPoint Presentation files are to be received by the Professor by 12:00 a.m. on March 14th. (A late submission could result in a 5% deduction per day. Missing the first midterm exam will increase the weighting of the second midterm and final exams by 10% each. Missing the second midterm exam will increase the weighting of the final exam by 20%.)

ACADEMIC INTEGRITY AND PROFESSIONAL CONDUCT:

The highest level of academic integrity is expected from students. Please consult Memorial University's Code of Student Conduct at <http://www.mun.ca/student/conduct>. 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 requiring physical or academic accommodations may speak privately to the instructor so that appropriate arrangements can be made. All conversations will remain confidential. Diversity of viewpoints, values, and backgrounds that each class participant possesses enrich the university experience. Insightful and comprehensive class discussion will be possible when dialogue is 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. A specific resource is the Writing Centre at <http://www.mun.ca/writingcentre/about/>.

ADDITIONAL INFORMATION:

WINTER 2014 SCHEDULE, Dr. C. A. Coles

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9:00					
9:50					
10:00			Engi 9605 10:00 – 11:15 am EN 4020		Engi 9605 10:00 – 11:15 am EN 4020
10:50					
11:00					
11:50					
12:00	Engi 8713 12:00 noon – 1:15 p.m. Tutorial, EN 2050		Engi 8713 12:00 noon – 12:50 p.m. EN 2050		Engi 8713 12:00 noon – 1:40 pm EN 2050
12:50					
1:00					
1:50					
2:00			Office Hour EN 3004 2:10 pm – 3:00 pm		Office Hour EN 3004 2:10 pm – 3:00 pm
2:50					
3:00					
3:50					
4:00					
4:50					

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