ENGG*3590 WATER QUALITY

School of Engineering, University of Guelph
Fall 2007

Instructor: Dr. Richard G. Zytner, P.Eng.; Room 2337 Thornbrough; Ext. 53859

GTA: Lab Section 1: Maryam Jedari Eywazi
Tutorial: Fraser Kent *GTAs have no office h; sufficient contact time in lab and tutorial*

Lecture Times: Tuesday and Thursday from 10:00 to 11:20 in MACK 226

Lab: Monday and Tuesday from 14:30 - 17:30 in Engr. 1196. Schedule will be posted on web.

Tutorial: Monday from 14:30 to 16:30 in Thornbrough 1103.

Office Hours: Just drop by. Fixed times are the tutorial slot on Monday, Wednesday @ 09:00 to 10:00 or by appointment.

Texts/Notes: Tchobanoglous, G. and Schroeder, E.D. 1987, *Water Quality*, Addison Wesley, 768p.
Zytner, R.G. 1998, *Water Quality Laboratory Manual*, SoE.
PDF files on Course Website

Exams: *Midterm*: Thursday October 18, 2007 in MACK 226 during the lecture slot - short answer/multiple choice.
Final: Monday December 7, 2007 from 19:00 to 21:00.

Prerequisites: As stated in the U of G Calender

Announcements: See web page http://www.soe.uoguelph.ca/webfiles/rzytner/WQ/WQ.html

COURSE SUMMARY

Water Quality is an essential course for undergraduate students in the Water Resources and Environmental Engineering programs. The concepts and principles presented give students the necessary engineering skills to address the water quality problems they will face in their senior year and upon graduation.

This course builds on the student's experience in chemistry, fluid mechanics, engineering science and provides an engineering perspective on:

- physical, chemical and biological characteristics of water
- standard methods of water quality analysis
- significance and interpretation of analytical results
- modelling of water quality in natural systems
- introduction to engineered water and wastewater treatment systems

EVALUATION

Literature Review and Water Bibliography	10%
Two Individual Laboratory Reports	15%
Selected assignment questions	5%
Midterm	30%
Final Exam	40%

Note: Students must attain a combined total of 50% on the examinations (Midterm and Final Exam) to pass the course. If not, that grade will be assigned for the course.

COURSE OUTLINE

I - Introduction, Sources of Water and Wastewater, Water Recycle 0.5 week

II - Physical, Chemical and Biological Characteristics of Water 5 weeks
- 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, Cryptosporidium

III - Analysis and Sampling Methods (*water and solid matrices)* 0.5 week
- 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)
- detection limits

IV - Simple river model (oxygen sag) 1 week

IV - Water Treatment 2.5 weeks
- history
- pretreatment - source, screens, pre-chlorination, sedimentation, aeration
- treatment - coagulation & sedimentation (Type I and Type II settling), filtration, ozonation, post chlorination
- overview of special treatment - activated carbon, fluoride, softening

V - Wastewater Treatment 2.5 weeks
- history
- pretreatment - source, screens, bar racks
- treatment - sedimentation (Type III and Type IV settling), attached growth, suspended growth, wetlands, septic systems
- overview of special treatment - tertiary treatment, BNR, membrane

LABORATORY EXPERIMENTS

Laboratory work will consist of the following five water quality tests:

- biochemical oxygen demand (BOD)
- coagulation and flocculation (C&F)
- coliforms - (total and fecal)
- chlorine demand
- solids - fractions, Type I and/or Type II settling

Assignments:

Approximately ten assignments will be issued throughout the term. Assistance will be available during the tutorial period (Monday from 14:30 to 16:30) to assist in solving the problems and to provide the solutions on request. **Please note that the solutions will not be posted.**

Literature Review:

Each student will complete one literature review on a water quality issue of her/his choice. The topic does not have to be approved by the instructor. The review should be based on six journal articles and should not exceed three pages plus references. The due date is September 28, 2007 @ 12:00 h in the drop off box. Late Literature Reviews will not be accepted. **There will be no exceptions.** See statement below on Academic Misconduct.

Laboratory and Laboratory Reports:

Six lab sessions have been scheduled, with students working in pairs (your choice). Specific schedules will be posted by the instructor on the Web Site. 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. If you own a lab coat, please bring it to the laboratory.

Each student will prepare two individually written lab report for one of the lab sessions using the appropriate data set. The topic and due date will be determined randomly by the instructor. Further detail on the lab reports is given in the lab manual. Late laboratory reports will not be accepted. **There will be no exceptions.** See statement below on Academic Misconduct.

Mid-Term Exam:

The material covered will include the last Thursday lecture prior to the exam. The exam will be closed book - multiple choice/short answers. Failure to write the exam will lead to a zero. The only exception will be for students with a medical reason signed by a physician. **There will be no exceptions.**

Final Exam:

The final exam will be comprehensive of all the material covered. Questions will be of the calculation format. Failure to attend the exam will lead to a zero for that exam. The only exception will be for students with a medical reason signed by a physician. **There will be no exceptions.**

PLEASE NOTE:

- **The Regulations concerning Academic Misconduct as outlined in the University of Guelph, Undergraduate Calendar for 2007-2008 will be strictly enforced.**
  - accordingly, when you submit your Literature Review and Laboratory Report, please include a statement that the submitted work was a solo effort. This also requires that you to provide your SMP number if you are an engineering student. Failure to include this statement and a valid SMP number will mean that your submission will not be graded.

- **There will be no supplemental work for improved grades.**
- **The GTAs have no office hours as there is sufficient contact time in the tutorials.**

DISLAIMER

The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to University of Guelph Academic Regulations.