MCSC 6010G: Mathematical Modelling

Fall 2010, M, R 9:40-11:00 am, J125

Instructor: Dr. C. Sean Bohun.
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Office Hours: Monday, 12:00-2:00 or by appointment.
Title: MCSC 6010: Industrial Mathematics (3), Section 001.
Description: This is a core course and forms an essential part of the MSc program. The student becomes familiar with the fundamental principles and techniques in mathematical modelling, showcased through the use of classical and advanced models in physics, biology and chemistry. Several analytical techniques are introduced through the study of the mathematical models presented. Topics may include population models and epidemiology, neuron and cell dynamics, nonlinear waves in biological, chemical and physical systems, fluid dynamics, pattern formation (in fluid experiments, animal coat patterns, chemical reactions, visual cortex), and coupled systems (neurons, traffic flow, lattice systems).
Prerequisite: Admission to the MSc program in Modelling and Computational Science.

Examination: Term work will consist of **3** assignments and **1** final exam.
Grading Policy: The final grades will be assigned as follows:

A+	90% - 100%	B−	70% - 72%
A	85% - 89%	C+	67% - 69%
A−	80% - 84%	C	60% - 66%
B+	77% - 79%	D	50% - 59%
B	73% - 76%	F	49% and below

IMPORTANT: It is possible that unforeseen circumstances may cause me to alter some of the information in this document. Any such alterations will be announced in class and followed up with a WebCT email message to the students of the class. If you miss any announcement because of inattention or absence from class, then you must accept the consequences of missing it.

Content and Timeline (tentative)

Date	Material covered	Date	Material covered
September 8	Regular and sing. pert. methods	October 24	Stefan problems
September 12	Regular and sing. pert. methods	October 27	Stefan problems
September 15	Matched asymptotic expansions	October 31	Case study: Flow in a wellbore
September 19	Matched asymptotic expansions	November 3	Case study: Flow in a wellbore
September 22	Traffic Models	November 7	Case study: Flow in a wellbore
September 26	NO CLASS	November 10	Case study: Flow in a wellbore
September 29	NO CLASS	November 14	Classical thermoelasticity theory
October 3	Traffic Models	November 17	Classical thermoelasticity theory
October 6	Traffic Models	November 21	Case Study: Cz crystal growth
October 10	NO CLASS	November 24	Case Study: Cz crystal growth
October 13	Traffic Models	November 28	Case Study: Cz crystal growth
October 17	Models of traffic, diffusion, heat	December 1	Leeway/Current research problem
October 20	Similarity solutions	December 5	Leeway/Current research problem

References

- Bohun, C.S., Frigaard, I., Huang, H. & Liang, S. (2006). A Semi-Analytical Thermal Stress Model for the Cz Growth of Type III-V Compounds. *SIAM Journal on Applied Mathematics*, **66**(5), 1533-1562.
- Bohun, C.S., McGee, B. & Ross, B. (2002). Electromagnetic Wellbore Heating. *Canadian Applied Mathematics Quarterly*, **10**(3), 353-374.
- Mathematical Models in the Applied Sciences, by Andrew Fowler (Chapter 5)
- Introduction to Perturbation Methods, by Mark H. Holmes
- Introduction to the Foundations of Applied Mathematics, by Mark H. Holmes (Chapter 2)
- Practical Applied Mathematics: modelling, analysis, approximation, by Sam Howison (Chapter 8)

Academic Honesty: Except for exams and tests, it is assumed that you can discuss problems and assignments among yourselves and with tutors and the professor, so long as what you turn in is your own work. In other words, the discussions are part of the learning process; once you learn how to approach a problem, you are expected to solve it yourself, write up your own submission, and that is what you turn in. It is dishonest to turn in as your own any work which has been copied from the work of someone else.

It is expected that each student enrolled at UOIT will become familiar with this policy and appreciate that academic dishonesty of any form will not be tolerated at UOIT. You are encouraged to carefully read the material in this section and to seek clarification from the appropriate Academic Advisor if necessary. Acts of academic dishonesty include, but are not limited to:

> Cheating: Copying answers to exam/quiz questions from another student's exam/quiz paper; copying an out-of-class assignment from another person and submitting it as part of an academic assignment.
>
> Facilitating academic dishonesty: Helping or attempting to help another to commit an act of academic dishonesty.
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> Plagiarism: Taking and passing off as one's own the ideas or words of another in any academic assignment.

A student charged with academic misconduct may face academic/or disciplinary sanctions. Read the University Policy on Academic Honesty which is located in Section 5.15 of the UOIT academic calendar `http://www.uoit.ca/calendar`

Term Work: The normal policy in the Faculty of Science for missed term work (tests and assignments) is to re-weight the remaining work to account for the missing grade. There are no make-up exams. If you miss a Science term test or major assignment due to illness or a death in the family you must obtain the appropriate documentation (UOIT Medical Certificate, death certificate), and submit it to the Science Academic Advisor within 5 days of missing the test or assignment. If you cannot write a test for any other reason, you must discuss this with the Science Academic Advisor and the instructor of the course at least 2 days before you are scheduled to write it. Exceptions to this rule include Varsity Athletics and test conflicts which have different deadlines. If you miss any exam for an invalid reason, you will receive zero for the exam.