MATH 4708/5408 – Asymptotic Methods – Fall 2022

Instructor: Dr. Lucy Campbell
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Lectures: Tues/Thurs 2:30–4:00 in Canal Building 2202

Course information: http://www.math.carleton.ca/~campbell/MATH5408
and in **Brightspace** (https://brightspace.carleton.ca)

About the course:

This course covers asymptotic and perturbation methods for obtaining approximate analytical solutions to problems involving linear and nonlinear differential equations. These methods allow one to analyze and obtain insight into complex problems, for example, in physics and engineering, for which closed form solutions cannot be obtained.

Topics:

- Asymptotic series: properties, matching, application to differential equations.
- Asymptotic expansion of integrals: elementary methods, methods of Laplace, Stationary Phase and Steepest Descent, Watson's Lemma, Riemann-Lebesgue Lemma.
- Perturbation methods: regular and singular perturbation for differential equations,
- Multiple scale analysis, boundary layer theory.
- WKB theory.

References:

- C. M. Bender and S. A. Orszag, Advanced Mathematical Methods for Scientists and Engineers **(available at the bookstore)**.
- A. H. Nayfeh, Introduction to Perturbation Techniques.

Prerequisites for the course:

Functions of a Complex Variable (e.g. MATH 3057) and Differential Equations (e.g. MATH 3008, MATH 3705).

Grading scheme:

The final grade will be calculated as:
25% Assignments
25% Midterm exam
50% End-of-term exam

Academic Accommodation:

Students with disabilities requiring academic accommodation in this course must contact a coordinator at the Paul Menton Centre for Students with Disabilities (PMC) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable). For pregnancy or religious obligations, write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.