

MATH-3113-WA PARTIAL DIFFERENTIAL EQUATIONS II
MATH-3133-WA METHODS MATH PHYSICS II
WINTER 2025

Instructor: Xin Yang LU

Class time: TTh 5.30-7pm in RB3049.

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Office Hours: MW 4.30-5.30pm in RB2015. However, before coming, please notify via email beforehand. Office hours can be also scheduled and delivered via Zoom, with a far more flexible choice of times.

DESCRIPTION

- **Textbook:** *Mathematical Methods for Physics and Engineering*, 3rd edition by Riley, Hobson, and Bence (Cost: 70 dollars - prices are subject to market fluctuations. Any version, or second hand copy, would work. Not required). Chapters to be covered: 20–22, and eventually 28, 29.
- **Topics:** We will roughly cover the following topics:
 - (1) Partial Differential Equations (PDEs): general and particular solutions
 - (a) Important PDEs (e.g. heat, wave, Laplace, etc.)
 - (b) General form of the solutions
 - (c) General and particular solutions
 - (d) Wave equation
 - (e) Heat equation
 - (f) Existence and uniqueness of solutions
 - (2) Separation of variables and other methods:
 - (a) Separation of variables: the general methods
 - (b) Superposition
 - (c) Separation of variables: in polar coordinates
 - (d) Integral transforms
 - (e) Green's function
 - (3) Calculus of variations:
 - (a) The Euler-Lagrange equation
 - (b) Constrained variation
 - (c) Physical variation principles
 - (d) Eigenvalue problems
 - (e) Eigenvalue and eigenfunctions estimates
 - (f) Adjustment of parameters

Eventually, we can cover the following topics:

- (1) Group theory:
 - (a) Groups
 - (b) Finite groups
 - (c) Commutative groups
 - (d) Permutation groups
 - (e) Mapping between groups
 - (f) Subgroups
 - (g) Equivalence classes
- (2) Representation theory:
 - (a) Dipoles
 - (b) Choosing an appropriate formalism
 - (c) Equivalent representations
 - (d) Reducibility of representations
 - (e) Orthogonality theorem

- (f) Product of representations
- (g) Physical applications
- **Assignments:** 3 assignments during the semester, each one counting for 15% of the final grade. You will have approximately two weeks to do each assignment.
- **Final Exam:** There will be a formal 3 hours final exam which will count for 55% of the final grade. There will be *NO* 100% final option.
- **Policies:**
 - Important announcements will be made through MyCourseLink to registered students via MyCourseLink. You are responsible for reading the info posted on MyCourseLink.
 - I attempt to reply to e-mail in a timely fashion, but do not expect immediate responses.
- **Academic Dishonesty:** All cases of academic dishonesty will be dealt with according to the university's Code of Student Behavior and Disciplinary Procedures, copies of which are available from the university's web-site.
- **Accommodations:** Lakehead University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you think you may need accommodations, you are strongly encouraged to contact Student Accessibility Services (SAS) and register as early as possible. For more information, please visit: <http://studentaccessibility.lakeheadu.ca>