

UBC Math 257: Partial Differential Equations

January-March 2014

This page provides official background information for all sections of two courses running this term:

- UBC Math 257 — Partial Differential Equations, and
- UBC Math 316 — Elementary Differential Equations II.

Daily readings, homework, and updates, are on the courses' [Unified Home Page](#).

Instructors

**Section 201, MWF 11:00-11:50,
in room MATH 100**

Kelly M. Paton

**Section 202, MWF 09:00-09:50,
in room CHEM B250**

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please)

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Topic Outline

Topic	Hrs	Description
Linear Ordinary Differential Equations	6	• Homogeneous ODE with Constant Coefficients • First-order • Second-order • Higher-order • Non-Homogeneous ODE with Constant Coefficients • Variable Coefficients: Euler Equations • Series: Geometric, p-series, Alternating series; Power Series and Taylor's Theorem • Power Series Solutions near an ordinary point • General Solutions • Initial-Value Problems

		• Non-homogeneous problems • Singular points: regular vs irregular • Series solutions near a regular singular point
Linear Operators and Eigenvalue Problems	6	• The matrix case • Operators and eigenvalues in function space • Sample eigenvalue problems • Orthogonality and eigenfunction series
Series Solutions of Boundary-Value Problems	6	• Separation of variables: eigenproblems, formal series • Propagating coefficients • Initialization • Special modes; superposition • Nonhomogeneous PDE • Nonhomogeneous BC
More General Eigenfunction Series	3	• Sturm-Liouville Theory • Examples
Numerical Methods	3	• Finite Differences • Stability Conditions • Spreadsheet Implementations
Heat Equation in Depth	3	• Derivation; BC's and their meanings • Transient versus long-run behaviour • Applications
Laplace's Equation in Depth	3	• Derivation and Interpretation • Superposition and splitting • Neumann problems and consistency conditions • Physical solutions are bounded functions • Problems in polar coordinates (Euler equations reappear)
Wave Equation in Depth	4	• Derivation; BC's and their meanings • D'Alembert's solution • Signal speed; reflections • Forcing and resonance • Special applications, e.g., circular drum, if time permits
Total Hours on Outline	34	• (34 lectures + 2 tests = 36 meetings this term)



Course Details

Required Text:

- None.

Recommended Reading:

Watch the main [course page](#) for writeups customized for this term's experience. In addition, consult the following:

- W. E. Boyce and R. C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*, any edition since about #5. New York: John Wiley & Sons, 1997.
- Froese, Richard G., [Partial Differential Equations](#). UBC M257/316 Lecture notes free on the Web.
- Peirce, Anthony, [UBC M257/316 course page for Sep-Dec 2013](#). Look especially at the section headed "Lecture Notes".

Other Nice Books:

- Churchill, R. V., and J. W. Brown, *Fourier Series and Boundary Value Problems*. New York: McGraw-Hill, 1993.
- Troutman, John L., *Boundary Value Problems of Applied Mathematics*. Boston: PWS Publishing Company, 1994.
- Main, Iain G., *Vibrations and Waves in Physics*, third edition. Cambridge University Press, 1993.

Holidays:

- Monday 10 February--Family Day in BC: UBC closed, class cancelled.

Evaluation:

- Weekly Homework (Mostly due Mondays), 5%.
- 12 February 2014 (Wednesday), Midterm I, 22.5%, in class.
- 12 March 2014 (Wednesday), Midterm II, 22.5%, in class.

Policies:

- Students may use **no resources except for writing equipment** on midterm and final examinations. This means **no formula sheet** and **no calculator**. Seriously.
- The final course grade is influenced only by what knowledge of the subject students demonstrate in the four activities described above.
- There is no supplemental examination in this course.
- Missing a midterm normally results in a mark of 0. Exceptions may be granted in two cases: prior consent of the instructor or a medical emergency. In the latter case, the instructor must be notified within 48 hours of the missed test, and presented with a doctor's note immediately upon the student's return to UBC.

Course Web Page (daily details appear here):

<http://www.math.ubc.ca/~loew/m257/>