
UBC Math 257: Partial Differential Equations

May-August 2014

This page provides official background information for two courses running in parallel:

- 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](#).

Instructor

Dr. Philip D. Loewen

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URI	http://www.math.ubc.ca/~loew/
Office Hours	Drop-in hours are shown below. Meetings outside these hours can also be arranged, but please reserve a time by email beforehand. Unexpected visitors often cannot be accommodated. <i>If you expect to need more than 15 minutes, please make an appointment.</i>

May-June 2014*

Mon	Tue	Wed	Thu	Fri
14:00-16:00	16:00-16:30	[none]	16:00-16:30	14:00-16:00

* I will be unavailable on some days. Please check "Daily Specials" below before trekking to MATH 207.

Daily Specials NONE: This week looks normal so far.

Topic Outline

Topic	Hrs	Description
Review of Series	5	• Convergence concepts • Geometric series and the ratio test • Error control and Shanks Transformation • Power series • Analytic functions, radius of convergence
Linear Ordinary Differential Equations	9	• Power Series Solutions near an ordinary point ◦ General Solutions ◦ Initial-Value Problems ◦ Non-homogeneous problems • Homogeneous ODE's with Constant Coefficients • Non-Homogeneous ODE with Constant Coefficients • ODE's of Euler type • Change of independent variable • Singular points: regular vs irregular • Series solutions near a regular singular point (Frobenius method)
Linear Operators and Eigenvalue Problems	6	• The matrix case • Operators and eigenvalues in function space • Sample eigenvalue problems

Eigenfunction-series solutions for Boundary-Value Problems	6	• Orthogonality and eigenfunction series • Separation of variables: eigenvalue problems, formal series • The Big Four standard eigenvalue problems • Propagating coefficients • Initialization • Special modes; superposition • Nonhomogeneous PDE • Nonhomogeneous BC
More General Eigenfunction Series	5	• Eigenvalue Problems • Orthogonality and Eigenfunction Series • Sturm-Liouville Theory • Full Fourier Series
Heat Equation in Depth	3	• Derivation; BC's and their meanings • Transient versus long-run behaviour • Splitting methods for nonhomogeneous boundary conditions
Laplace's Equation in Depth	4	• 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 • Travelling wave solutions • D'Alembert's solution • Signal speed; reflections • Forcing and resonance
Numerical Methods	2	• Finite Differences • Spreadsheet Implementations
Total Hours on Outline	44	• (44 lecture-hours + 2 test-hours = 46 meetings this term)

Course Details

Required Text:

- William F. Trench, *Elementary Differential Equations with Boundary Value Problems*, 2013. Book 9 in the collection *Books and Monographs* available free online at <http://digitalcommons.trinity.edu/mono/9>.

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.

Important Dates:

- Tuesday 13 May: Class starts, 14:00 in room LSK 200.
- Thursday 19 June: Midterm test in class. 90 minutes.
- Friday 20 June – Wednesday 2 July: no classes.
- Thursday 3 July: Classes resume after mid-session break.
- Thursday 7 August: Last class of the term.

- Tuesday 12 August – Saturday 16 August: Official exam period.

Evaluation:

- Daily Participation (bring your iClicker to class), 0-2%.
- Weekly Homework (Due every Tuesday), 10%.
- 19 June 2014 (Thursday), Midterm Exam, 38-40%, in class.
- 12-16 August 2014, Final Exam, 50%, scheduled by UBC Enrolment Services.

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 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/>

Last update: 12 May 2014 (Mon), 12:00:10.



(Click a graphic to recheck.)