MATH 400 (3 Credits) Section 101
Applied Partial Differential Equations
Session 2020W Term 1 (Sep–Dec 2020)

Prerequisite. Complex variables (one of MATH 300, MATH 305) and an introduction to partial differential equations and Fourier series (one of MATH 256, MATH 257, MATH 316, MATH 368, MECH 368, PHYS 312). Implicit prerequisite: multivariable calculus, vector calculus, and linear algebra.

Instructor. Wayne Nagata
Office Hours. M W F 14:00–14:50 Vancouver BC local time
Office Location. Online
Contact Details. Drop in (see the course Canvas page) to office hours, or email `nagata@math.ubc.ca` for a simple question or to make an appointment for a Zoom session.

Course Canvas Page. `https://canvas.ubc.ca/courses/55322`

Instructor's Web Page. `https://www.math.ubc.ca/~nagata/m400/`

Course Structure. Online version of traditional lectures and/or Q&A sessions, M W F 09:00-09:50 (Vancouver BC local time – note that Daylight Saving Time ends Nov 01). Preliminary notes will be posted before lecture times on the instructor's web page, updated notes will be posted after lecture times on the course Canvas page.

Course Topics.

1. *First Order Equations:* Simple transport; Linear first order equations; Characteristics and coordinates; Variable coefficients; Traffic flow; Dimensional analysis and scaling; Quasilinear equations.

2. *Linear Second Order Equations:* Classification.

3. *The Wave and Diffusion (Heat) Equations:* Vibrating string; Wave equation; Heat flow; Diffusion (heat) equation.

4. *Separation of Variables and Sturm-Liouville Theory:* Separation of variables; Sturm-Liouville boundary value problems; Sturm-Liouville theory and applications.

5. *Laplace's (Potential) Equation:* Temperature distributions; Laplace's (potential) equation; Harmonic functions; Poisson's formula.

6. *Special Functions:* Vibrations of a drum; Laplace's equation in a solid ball; Spherical harmonics.

7. *Integral Transform Methods:* Fourier transforms and applications; Laplace transforms and applications.

8. *Introduction to Nonlinear Equations:* Modal truncation; Reaction-diffusion equations.

Course Textbook. Optional.

- W. A. Strauss, *Partial Differential Equations: An Introduction,* Wiley (2008).
- See the course Canvas page for more references.

Learning Outcomes. See the instructor's web page.

Learning Assessment. See the course Canvas page.

Homework assignments submitted late are not marked. There are no make-up tests for missed midterm tests. If academic concession for a missed homework assignment or midterm test is requested by a student and approved by the course instructor, then the marks for the missed component are shifted onto the final examination. Examples of valid reasons include illness and being absent from home to represent the University, British Columbia or Canada in a competition or performance. Examples of reasons that are not valid include conflicts with personal travel schedules or conflicts with work schedules. **Note that a student who misses the midterm test and has otherwise not completed a substantial portion of the term work shall not be admitted to the final examination.**

If the final examination is missed, a student can apply for academic concession to their dean or director or their designate (such as an academic advising office). A student's academic performance in a course up to the final examination is taken into consideration in granting deferred examination status (e.g. if a student is already failing then deferred examination status will not be granted). **Note that a conflict with a student's personal travel schedule is not a valid reason for missing the final examination.** A student who misses the final examination for this reason will receive a mark of 0 for the final examination and therefore will fail the course.

For more details on academic concession see the UBC Calendar website `http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,329,0,0`.

University Policies. UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the UBC Senate website `https://senate.ubc.ca/policies-resources-support-student-success`.

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