MATH 333: Partial Differential Equations
Syllabus, Fall 2024

Course Information.

- 4 semester hours
- Professor: Thomas Scofield
- Prerequisites: MATH 231 and MATH 271
- Text: Applied Partial Differential Equations, 3rd Edition, by J. David Logan
- Class meetings: MWF, 8:00–9:05 pm, NH 251

Catalog Description.
An introduction to partial differential equations and their applications. Topics include mathematical modeling with PDEs, nondimensionalization, orthogonal expansions, solution methods for linear initial and boundary value problems, asymptotic expansions, and numerical solution of PDEs.

Student Learning Outcomes. Upon completion of this course, students will be able to

- Derive PDEs which model heat flow and vibrating strings.
- Solve PDEs using Fourier series and orthogonal expansions.
- Determine the error between the true solution and a finite-sum approximate solution.
- Numerically solve some canonical PDEs using finite differences and finite elements.
- Solve diespersive PDEs on the line using the Fourier transform (time permitting)

Topics.

1. Derivation of canonical models for heat flow and vibrating strings
2. Qualitative behavior of solutions for the heat equation and Laplace's equation
3. d'Alambert's traveling wave solution for the wave equation on the line
4. Finite differences numerical approximation of solutions
5. Finite element numerical approximation of solutions
6. Fourier series and orthogonal expansions
7. Sturm-Liouville theory for infinite-dimensional eigenvalue problems
8. Infinite series solution for one-dimensional heat and wave equations
9. Finite sum approximations and error analysis for heat equation
10. d'Alambert's solution and reflection of waves off boundaries
11. Infinite series solutions on circular and rectangular plates
12. Integral representations of solutions using the Fourier transform

Methods of Evaluation.

Assessment	Pct
Assignments	50%
Midterm tests (Oct. 9 and Nov. 22)	30%
Final (Dec. 14, at 1:30 pm)	20%

Policies.

- You are expected to attend class faithfully, in person, ready to go as class begins. When you cannot, regardless of reason, you are responsible for catching yourself up.
- Written work should be neat and well-organized, legibly written (if not typeset) in complete sentences, and providing justification in the form of reasoning and mathematical or computational work/plots with shared code. You are expected to be aware of assignments and their due dates. If you are unable to submit work by the due date, you may use one of your allotted late passes in MyOpenMath, adhering to the extra time it provides, until such time that you have used up your passes. Manage the 6 late passes you have well, saving ones for unforeseen circumstances.
- Unless directed otherwise on specific assignments, you may freely collaborate with classmates as you explore problems. Your write-ups are to be your own, however. Sections grafted from another student's work, whether in homework or on a test, shall be considered *cheating*, and shall result in an "F" on that assignment or test. The same goes for unauthorized use of aids, and "work" that you cannot explain (answers produced by Wolfram Alpha or some AI engine, for instance). A second instance shall result in a course grade of "F".
- You are expected to take exams on the dates specified, or provide sufficient cause why you cannot. Family trips, pre-arranged flights, etc. are *not* sufficient.

Accommodations. Calvin University is commited to providing reasonable accommodations for students with disabilities. Students with a documented disability should notify a Disability Coordinator in the Student Success Office (HH 227) to discuss appropriate accommodations. If you have an accommodation memo, talk with me early about arrangements, preferably within the first 2 weeks of the semester.

Exceptions. I reserve the right to make changes or exceptions to course policies, including those described in this document, either for the entire class or for individuals. The ultimate goal in this course is **learning**, and formal requirements should not unnecessarily stand in the way of that. Thus, if you think that any of the conditions of the course are interfering with learning, please speak with me about this, and we will consider what can be done.