MATH 674
Applied Partial Differential Equations

Class Policies

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Fall 2012
Class: W 5:30-8:10
Room: YR 121
Section: 101
Office Hours: Tu 1-2 and by appointment

Prerequisites: Prerequisite: MATH 374 (or MATH 574), MATH 379 (or MATH 579), or consent of chairperson.

Catalog Description: Discussions of the typical partial differential equations of applied mathematical physics: Heat equations. Wave equations, Beam equations, Laplace equations. Separation of variables, variation of parameters and Fourier transform for initial and boundary value problems, Calculus of variation and Ritz-Galerkin's numerical method.

Instructional Material The primary text is

- J. Kevorkian, *Partial Differential Equations*, Springer Verlag, 1999

Other useful references include:

- E. C. Zachmanoglou & Dale W. Thoe, *Introduction to Partial Differential Equations with Applications*, Dover Publications, 1987.
- George Lamb, *Introductory Applications of Partial Differential Equations*, John Wiley & Sons, 1995.
- John Ockendon, Sam Howison, Andrew Lacey, & Alexander Movchan, *Applied Partial Differential Equations*, Oxford University Press, 2003.
- Aslak Tveito & Ragnar Winther, *Introduction to Partial Differential Equations*, Springer Verlag, 2004.
- Fritz John, *Partial Differential Equations*, Springer Verlag, 1981.
- Harold Levine, *Partial Differential Equations*, American Mathematical Society, 1997.
- Richard Courant & David Hilbert, *Methods of Mathematical Physics*, John Wiley & Sons, 1991
- David Bleecker & George Csordas *Basic Partial Differential Equations*, International Press, 1997.

Course Topics: The following is the planned list of course topics (with the corresponding section in our primary text); we may add or subtract material depending on the balance of available time in class.

1. Preliminaries. Appendix A.1, A.3.1. Green's functions for differential equations. The Dirac Delta. Order notation.

2. The Diffusion Equation. Chapter 1, sections 1.1-1.7. Fundamental solution of the heat equation. One-dimensional problems on an infinite domain, a semi-infinite domain, and on a bounded domain. Higher dimensional problems. Burger's equation.
3. Laplace's equation. Chapter 2, sections 2.1-2.6. The two-dimensional problem. The fundamental solution. Volume, surface, and line distributions of sources and dipoles. Green's formula. Green's function and Neumann's function.
4. The Wave Equation. Chapter 3, sections 3.1-3.7. The vibrating string. Shallow water waves. Compressible flow. One-dimensional problems on infinite, semi-infinite, and bounded domains. Lower derivative terms. Dispersive waves in one dimension. Three dimensional waves; acoustics.
5. Quasilinear First-Order Equations. Chapter 5, sections 5.1-5.3. Conservation laws in two dimensions. Strict solutions. Weak solutions, including shocks, fans and rarefaction waves.

Attendance: Attendance is expected; you should only miss a class for a compelling reason. If you do miss a class, you are responsible for any material that you miss, including any homework assignments given in that class. Unexcused absences can result in a lower grade.

Students should not attend classes or other university events from the onset of flu-like symptoms until at least 24 hours after the fever subsides without the use of fever reducing medications. Such absences will be considered excused absences; however, students are responsible for the material covered during the period of their absence.

Grading: Problem sets will be assigned each week; they will be collected 1-2 weeks later. There will be no midterm examinations, but there will be a final exam. The final grade shall be determined by a weighted average of the homework grade and the final exam grade; the final exam is worth 30% and the homework assignments will be worth 70%.

Guidelines for Homework:
1. Late work will not be accepted without a compelling reason.
2. Assignments are required to be neat, clean, and paper-clipped or stapled.
3. Assignments must include the authors name, and a brief description of the assignment.
4. Students are allowed to discuss homework problems with their classmates, however all work that is turned in must be the students own work.

Any assignment that does not meet these criteria may receive a deduction in score, or more generally will simply be rejected.

Final Exam: The Final Exam is scheduled for Wednesday, December 19, from 5:15-7:15 pm; please note the time. The final exam will not be rescheduled. Attendance is expected; a make-up exam will not be given without an extremely compelling reason. The final exam shall be comprehensive.

Academic Integrity The nature of higher mathematics requires that students adhere to accepted standards of academic integrity. Violations of academic integrity include cheating, plagiarism, falsification and fabrication, complicity in academic dishonesty, personal misrepresentation and proxy, bribes, favors and threats. Cheating is a serious offense that will have grave consequences for your academic life.

Students who violate these standards will either fail the course outright or, at the instructors discretion, may merely receive a zero on any assignment for which the student receives inappropriate

assistance. Particularly serious violations of these standards will be referred to the administration for possible additional action.

Withdraw: The last day to withdraw from the course with a grade of W is November 7.

Help: If you have difficulty completing a homework assignment, do not hesitate to ask for help, either from your friends, or from me. You are welcome to stop by my office, for whatever reason, and at whatever time, even if there are no office hours scheduled then. If you wish, you may also simply send an e-mail message.

Web Page: My web page at http://www.towson.edu/ moleary has copies of all of the old exams that I have given while at Towson.