Math 647 – Applied Partial Differential Equations

Spring 2019
1:00-2:15 TR, Snow 152

Instructor: Prof. Mathew A. Johnson
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Office Hours: Monday 10-11, Thursday 2:30-3:30, and by appointment.
Prerequisites: Math 220, Math 223 and Math 290, or Math 320.
Required Text: "Partial Differential Equations: An Introduction" by Walter A. Strauss.

Course Description: The purpose of this class is to introduce students to the origins, theory, and applications of partial differential equations (PDE). Several basic physical phenomena are considered, including vibrations and diffusion, and are used to derive the relevant mathematical equations. The fundamentals of the mathematical theory of PDE are motivated and developed for the students through the systematic exploration of these classic physical systems and their corresponding equations: the transport, wave, heat, and Laplace equations.

In addition to treating the physical origins of various PDE, this course focuses on solving evolution equations as initial value problems posed on unbounded domains (the Cauchy problem), and also on solving PDE on bounded domains (boundary value problems). While many explicit solution methods for such problems exist (we will survey many of them throughout the course), such methods often either produce solutions from which little usable information can be extracted or the solution method requires very special geometric requirements on the spatial domains (or both!). As such, it is often just as important[1] and useful in the analysis of PDE to understand the qualitative properties of solutions in the absence of explicit solutions. In addition to finding explicit solution techniques, we will also attempt to analyze the general behavior of solutions of a PDE without actually solving them. Such qualitative analysis is of fundamental importance in practice where explicit solution formulas for a given PDE either describe only trivial states or else don't exist. In particular, we will learn about the underlying structure of various PDE and ways that one can exploit this structure to provide useful and practical information.

Lecture: You are expected to attend every class. Reading the sections to be covered prior to the lecture is expected and will make the lectures MUCH more meaningful and useful. Parts of the lecture will serve as a "mathematical discussion" in which you are expected to participate. Finally, if you do miss a class it is your responsibility to make up missed material on your own time.

[1] In my personal opinion, I would say it is in fact *more* important.

General Information: All handouts, homework, solutions, etc. will be made available at the course website. Grade information will be available from Blackboard.

Homework: Homework will be assigned (usually) weekly and will be collected at the beginning of the lecture. You should check the course website regularly for homework assignments, solutions to selected problems, and course handouts and announcements. **Late homework will not be accepted**, but your lowest homework score will be dropped. Homework is a major part of the learning process in Mathematics and, as such, it is essential that students work on the problems regularly. It is your responsibility to seek help on all problems that you can not do. Although each student must submit their own solutions, students are (strongly!) encouraged to work together on homework. Help is also available during office hours and by appointments with me.

You must legibly write your name and class (Math 647) at the top right portion of any graded homework you turn in. Graded homework must also be stapled and folded in half (lengthwise) to be accepted.

Exams: There will be two midterm exams held during our regular class time The dates for these exams will be announced at least a week in advance. As the midterm exams are scheduled during our normal class period, there will be **no makeup exams**, except in the event of a documented emergency, and then only with my prior permission (which will only be granted in extreme circumstances). In particular, airline tickets, jobs, weddings, or (attending) athletic events are not considered to be valid excuses for missing an exam.

The final exam will be comprehensive and is scheduled for **Thursday, May 16 from 1:30pm-4:00pm.**

Course Grades: The components of your grades are as follows:

- Homework: 30%
- Midterm Exams: 20% Each
- Final Exam: 30%

Maximum cutoffs for letter grades will be at the traditional 90%, 80%, etc. with plus and minus grades given at approximately $\frac{1}{3}$ intervals. Curves may be given, but are rare and will only be applied at the very end of the course.

Students with Disabilities: The staff of the Academic Achievement & Access Center (AAAC), 22 Strong, 785-864-4064, coordinates accommodations and services for KU courses. If you have a disability for which you may request accommodations in KU classes and have not contacted them, please do so as soon as possible. Please also see me in regard to accommodations necessary in this course.

Policy on Religious Observances: Any student in this course who plans to observe a religious holiday that conflicts in any way with the course schedule or requirements should contact the instructor as soon as possible to discuss alternative accommodations.

Policy on Commercial Note Taking: Pursuant to the University of Kansas Policy on Commercial Note-Taking Ventures, commercial note-taking is not permitted in Applied Partial Differential Equations (Math 647 - Spring 2019). Lecture notes and course materials may be taken for personal use, for the purpose of mastering the course material, and may not be sold to any person or entity in any form. Any student engaged in or contributing to the commercial exchange of notes or course materials will be subject to discipline, including academic misconduct charges, in accordance with University policy. Please note: note-taking provided by a student volunteer for a student with a disability, as a reasonable accommodation under the ADA, is not the same as commercial note-taking and is not covered under this policy.

Policy on Campus Concealed Carry: Individuals who choose to carry concealed handguns **are soley responsible to do so in a safe and secure manner in strict conformity with state and federal laws and KU weapons policy.** Safety measures outlined in the KU weapons policy specify that a concealed handgun:

- Must be under the constant control of the carrier.
- Must be out of view, concealed either on the body of the carrier, or backpack, purse, or bag that remains under the carrier's custody and control.
- Must be in a holster that covers the trigger area and secures any external hammer in an uncocked position.
- Must have the safety on, and have no round in the chamber.