Math 7313, Spring 2013
Partial Differential and Integral Equations

Course Information

26843 Math 7313.501 TuTh 8:30pm-9:45pm FO 2.604

Professor Contact Information

Instructor: John Zweck

Office: FO 3.704J

Email: zweck@utdallas.edu; jwz120030@utdallas.edu

Webpage: I will maintain a web page for the course, linked from my web page http://www.utdallas.edu/~zweck. *Bookmark it!* I will also communicate with you using a class email list. (I do *not* use eLearning.)

Phone: (972) 883-6699 (Do not leave a message. Email me instead.)

Office Hours: M 2-3pm, F 1-2pm *and by appointment*. If you cannot come to my office hours *please* contact me in class or by email to set up a time to meet. Also, you are encouraged to ask me questions by email.

Course Pre-requisites and Co-requisites

The recommended prerequisite is MATH 6316 (Differential Equations II).

Course Description

Catalogue Entry: *Topics include theory of partial differential and integral equations. Classical and modern solution techniques to linear and nonlinear partial differential equations and boundary value problems. Introduction to the theory of Sobolev spaces.*

More specifically, topics to be covered will include:

- **General concepts**: Linearity, well-posedness, initial and boundary value problems.
- **Diffusion**: The heat equation, existence and uniqueness of solutions, fundamental solutions, symmetric random walks, and Brownian motion.
- **The Laplace/Poisson Equation**: Properties of harmonic functions; Representation formulae for solutions in terms of potential functions, including both single and double layer potentials.

- **First order equations and scalar conservation laws:** Traffic dynamics, the method of characteristics, integral (weak) solutions, the formation of shocks.
- **Waves and Vibrations:** Fundamentals of wave propagation; the classical formulae of d'Alembert, Kirchoff, and Poisson.
- **Nonlinear wave equations:** the KdV and non-linear Schrödinger equations, solitons, applications to water waves and nonlinear optics.
- **Weak solutions and regularity theory:** An introduction to distributions, Sobolev spaces, and weak solutions and regularity theory for elliptic equations.

Required Textbooks and Materials

The required text for the course is the one by Salsa, referenced below. The following texts on Partial Differential Equations are all recommended and represent a range of perspectives and levels of sophistication.

[SS] "Partial Differential Equations in Action: From Modeling to Theory", by Sandro Salsa, Springer, 2008.[1]

[LE] "Partial Differential Equations", by Lawrence Evans, American Mathematical Society, 2010

[WS] "Partial Differential Equations, An Introduction", by Walter Strauss, Wiley, 1992

[MG] "Partial Differential Equations", Analytical and Numerical Methods", by Mark Gockenbach, (2nd Edition), SIAM, 2011.

[OHLM] "Applied Partial Differential Equations", by Ockendon, Howison, Lacey, and Movchan, Oxford University Press, 1999.

[DK] "Distributions: Theory and Applications", by J. Duistermaat and J. Kolk, Birkhuser, 2010.

Academic Calendar and Assignments

The Lecture Notes and Homework Assignments are available on my web page. Homework problems for material covered on **Th, Tu** will be due at the *start* of class the following **Tuesday**. Most of the problems will be graded. Make sure your homework paper is *stapled*.

[1] The text is available on-line through the UTD Library

Grading Policy

Grades: Homework 30%, Midterm One 20%, Midterm Two 20%, Final 30%

Midterm Exams: There will be two midterm exams, each two hours.

- Midterm 1: Tuesday, Feb. 19th.
- Midterm 2: Tuesday, Mar. 26th.

Final Exam: Thursday May 9th, from 8pm-10:45pm. (Time subject to change.) The final will be based on the whole course and will be 2 hours 30 mins.

How I assign final grades

For each exam I work out how many points I expect a student who has a solid understanding of the material to get. I tend to put the bottom B near this score. Then I work out where to place the bottom A,C,D using the grade distribution and by looking at individual exams. I also work out the bottom A,B,C,D for the homework. Then I take an imaginary student who got the bottom B (say) for each component of the course and calculate their score. If your score is higher than the imaginary student's you get a B. To decide on the grades of borderline students I look carefully at performance on the final exam. In brief, I reward "strong finishers" who can show me they have a solid understanding of the entire course.

Instructor Policies

Homework

No late homework will be accepted! **Your lowest two homework grades will be dropped.** You may ask me questions about the homework and you may collaborate with another student in the class. In fact you are encouraged to do so! However the final write up is your own – *two identical homework papers will both be given zero.* I do not encourage large groups of people to work together on homework. Do not miss class to complete a homework. *I will not accept homework that is handed in after the first few minutes of class.*

Making up an exam you missed

If you miss one of the exams you *may* be given the chance to take a make up exam. To request a make up you should contact me **no later than 48 hours after** the exam time. Generally speaking, you will be offered a make up if you are sick or if a close relative or friend is gravely injured/sick or dies. However I will listen to all reasonable requests. Be prepared to bring appropriate evidence in support of your request.

Academic Integrity

I will be vigorous in reporting all instances of cheating to the University administration. See http://www.utdallas.edu/deanofstudents/dishonesty/

UT Dallas Syllabus Policies and Procedures

The information at http://go.utdallas.edu/syllabus-policies constitutes the University's policy abd procedures segement of the course syllabus.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.