Math 404 Introduction to Partial Differential Equations I

Spring Semester, 2006
Monday-Wednesday 5:30-6:45pm M/P 008
Instructor: Jonathan Bell M/P 405
Office hours: right after class, or by appointment (see me, or contact Mr. Mashbaum, or drop by the office. If I have a few minutes I will try to help you.)
Contact information: email: jbell@math.umbc.edu
Phone: 410-455-2405 (often best to contact Mr. Mashbaum For an appointment at 410-455-2401)
Website: http://www.math.umbc.edu/~jbell/math404

Text: **Partial Differential Equations, An Introduction**, by Walter A. Strauss, John Wiley & Sons, 1992.

Comments on Course Content: I have adopted a different textbook, but I will cover the topics I did in a previous course, namely:

1. Introductory remarks: PDE examples, order, superposition principle, homogeneous and non-homogeneous equations, boundary conditions, comments on ODEs, classification of 2^{nd} order equations
2. Diffusion equation: some properties of solutions for different boundary conditions, steady state solutions; separation of variables method and representation of solutions in terms of Fourier series; eigenvalue problems; 2D and 3D problems
3. Laplace equation: solution on various domains
4. Comments about PDEs and well-posedness; compatibility conditions; counterexamples
5. Fourier series: convergence results, integration and differentiation of series, rate of convergence, speeding up convergence
6. Wave equation: solution of various problems, Bessel functions and circularly symmetric vibrating membranes
7. Sturm-Liouville problems: regular problems, Rayleigh quotient and minimization principle, application to PDEs
8. Non-homogeneous problems and transforms: finite Fourier transforms, Fourier and Laplace transforms, example problems
9. Green's function technique to solve boundary value problems
10. First order problems, method of characteristics, linear examples
11. Remarks on other topics (inverse problem examples, free boundary problems, etc) as time permits

This is not exactly the order of topics in the text, so there will be some jumping around. I never lecture to the text, or any single source, so classroom lectures emphasize techniques and concepts of particular value (and guide what I test on). But I think the new textbook will be easier to read and follow than the previous text. But as a partial guide of topics corresponding to the above list, we will cover significant portions of chapters 1, 2, 4, 5, and parts of chapters 3, 7, 10, 11.

This course assumes that you have remembered and are comfortable with significant portions of calculus and elementary differential equations. It may be necessary for you to brush up on those subjects. In the first week we will do some review of differential equations.

Grading Policy: The course grade will be based on one mid-term exam (25% each), homework (35%), and a comprehensive final exam (40%). Letter grades will be based on the weighted sum of scores and generally follow the 85-100% being A, 70-84% being B, 55-69% being a C, etc. That said, overall distribution of accumulated scores and consistency of homework performance will affect the final letter grade.

Homework: Homework assignments will be given weekly and posted on the course website. (I will have a grader for homework.) I will specify when each assignment is due, but often I give a week to do the work. *Late homework submissions are **not** accepted, but two homework assignments with lowest scores will be disregarded*.

Exams: The mid-term exam will be given in the 7th or 8th week of the semester. It somewhat depends on where we are with the lessons are at the beginning of March. **No make-up exams** will be given except in the case of a documented serious emergency, which will require **written documentation**. In such case, I need to be notified **before** the exam period except in most exceptional cases. According to the registrar's chart, the final exam is scheduled for Monday, May 22, between 6:00-8:00 pm. It will be a two-hour comprehensive written examination.

Academic Conduct and Policy: I do not discouraged you to work in groups and discuss homework problems among yourselves. However, any material you turn in for grading should represent your own work. Any collaboration during writing solutions to the homework assignment and during an exam is strictly prohibited. Blatant copying (or aiding someone else to copy) on an exam or homework assignment will result in a grade of zero on that work. A repetition of such an act can result in stricter penalties. Academic integrity is an important value at UMBC and I support this. The following is the official UMBC statement on academic conduct.

By enrolling in a course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to suspension or dismissal. The following are examples of academic misconduct that are not tolerated at UMBC.

- *Cheating*: knowing using or attempting to use unauthorized material, information, or study aids in any academic exercise.
- *Fabrication*: intentional and unauthorized falsification or invention of any information or citation in an academic exercise.
- *Facilitating Academic Dishonesty*: intentionally or knowingly helping or attempting to help another commit an act of academic dishonesty.
- *Plagiarism*: knowingly representing the words or ideas of another as one's own in any academic exercise, including works of art and computer-generated information/images.

To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Directory.