MATH 673 (AMSC 673): Partial Differential Equations I
Department of Mathematics, UMCP **Fall 2010**
Handout 1: SYLLABUS AND POLICIES

Lecture Room: MATH 0103 **Time:** MWF 9:00a.m.– 9:50a.m.

Instructor: Dio Margetis; e-mail: dio@math.umd.edu
Office: MATH 4416; telephone: (301)405-5455.

Office hours: Monday 10-11:00am; or by appointment. Since I am occasionally called away for research matters, it is advisable to check with me as to whether I will be in my office at the indicated hours.

Teaching Assistant (TA)/Grader: Mr. Xuwen Chen (chenxuwen@math.umd.edu).
TA Office hour: Tues 1:00-2:00pm, or by appointment.

Prerequisites: Typically, MATH 411 (Advanced Calculus II), or equivalent. The course is largely self-contained; however, prior familiarity of students with analytic proofs will be very helpful. Ask for instructor's permission if you are in doubt.
Note: A primary purpose of MATH673 is to prepare graduate students of the Mathematics Department for the PDE Qualifying Exam. Hence, the material for this course is well defined and fixed, and the level of instruction is close to the main text (described below). The assigned homeworks will include many problems at the level of the PDE qualifying exams.

Text: The main textbook is L. C. Evans, Partial Differential Equations, AMS, 2002 (reprinted) or 2008; for a list of errata for this text see **note** in Handout 2. **Reading and some (but not all) problems will be assigned regularly from this text.** A few other recommended texts as well as more specialized texts for further reading (listed in the suggested bibliography, Handout 2, for the course) will also be consulted or partly followed.

Course Web page (evolving): http://www.math.umd.edu/∼dio/courses/673/
All homeworks and practice problems will be posted at this website.

Grading policy: Grades will be based on: (i) homeworks (5-7 problem sets) by 90%; and (ii) ONE 50min in-class exam by 10%. The date for the in-class exam is Wed. Oct. 20. The exam problem(s) will be very similar to (or easier than) the homework problem(s). Each homework set will be due (usually) 1.5 or 2 weeks after it is handed out.

Once assigned, the homeworks must be turned in by the date specified. Your solutions are required to be *legible and clear*. You are encouraged *but not required* to prepare your homework sets by using a word processor. Illegible problems will not be graded.

Scope and topics: The course encompasses concepts and analytic methods that permeate the rigorous theory of Partial Differential Equations (PDE), especially PDE that arise in applications. Emphasis will be placed on the existence, uniqueness and regularity of solutions as well as special solution techniques (e.g., transforms).

Topics to be covered:

Introduction: Classical and weak solutions; regularity. Major linear PDE. *Transport equation*: Initial-value problem; nonhomogeneous problem. *Laplace and Poisson equations*: Derivations; boundary value problems; fundamental solution; maximum principle; properties of harmonic functions; Green's function; energy methods. *Heat equation*: Derivations; initial value problems; fundamental solution; properties and estimates; energy methods. *Wave equation*: Derivations; initial value problems; d'Alembert formula; solution by spherical means; nonhomogeneous problem; energy methods. Applications in classical and quantum mechanics.

Nonlinear first-order PDE: Complete integrals; characteristics; calculus of variations and Hamilton-Jacobi equations; conservations laws; shock formation and entropy condition; weak solutions; the Riemann problem. Applications in gas dynamics, materials science and fluid mechanics.

Special representation of solutions: Fourier & Laplace transforms; conversion of nonlinear to linear PDE (Hopf-Cole transform, potential functions, hodograph and Legendre transforms). Applications in fluid mechanics, statistical physics and materials science.

Maximum principles for 2nd-order elliptic equations: Weak maximum principle; strong maximum principle; Harnack's inequality.

Note on Academic Integrity. You are expected to read carefully and adhere to the following instruction provided by the Student Honor Council.

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.shc.umd.edu.

To further exhibit your commitment to academic integrity, remember to sign the Honor Pledge on all assignments: *"I pledge on my honor that I have not given or received any unauthorized assistance on this assignment."*

Additional note for MATH 673: You will not be asked to sign such a pledge on possible homework assignments, but you are nevertheless expected to adhere to the principles of the pledge. The rationale for the pledge is available online at http://www.umd.edu/honorpledge.

Students With Disabilities. If you have a documented disability and need academic accommodations, please contact the instructor (me) as soon as possible.

Religious Observances. If you will be absent from class because of religious observances, please submit a list of the dates of your absences within a couple of days.