Math 483/683. Partial Differential Equations.
Syllabus. Spring 2014.

General.

Course. Math 483/683. Partial Differential Equations. 3 credits.
Textbook. S. J. Farlow. *Partial Differential Equations for Scientists and Engineers*. Dover, 1993.

Contact information.

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Course description.

First and second order partial differential equations, classificaion, examples, solution methods for the wave, diffusion, and Laplace equations, causality and energy, boundary value problems, separation of variables, Green's identities, Green's functions. Prereq: MATH 266.

Grading.

Everyone is graded the same way. NO EXCEPTIONS.
Letter grades A/B/C/D are based on a strict 90/80/70/60 cutoff. NO CURVING.
Problems are graded on a 10-point scale: (A) 9 or 10; (B) 8; (C) 7; (D) 6; (F) 4 or 5.

Your solution to a problem must clearly show a grasp of relevant concepts as well as a correct result for full credit. Organization counts. Neatness counts. Grading is based on what is actually written, not what is intended.

If an approach is specified in a problem, then that approach *must* be used in solving the problem. If no approach is specified, then any valid method is acceptable (with the understanding that the instructor may require a demonstration of its validity).

Late homework will not be accepted. The lowest three assigned problems, including problems not turned in, will be dropped.

Semester grade. The total grade will be based on the semester's homework problems and a final exam covering the semester's material. Math 683 students must complete a written project. The semester grade is determined by

Math 483:	
Homework	70%
Final	30%

Math 683:	
Homework	60%
Project	10%
Final	30%

Math 683 project deadlines:

(a) Approval of project topic by instructor: Week 7.
(b) Preliminary draft to instructor: Week 11.
(c) Final report: Last week of class.

Homework instructions.

(a) Put your name on every page.
(b) Identify each problem by its assigned designation (e.g. HW 08, HW 79, etc.).
(c) Start each problem on a new page (unless specifically allowed otherwise).
Do NOT start a solution on the back of another solution.
(d) Staple the pages of a single problem together. Do NOT staple different problems together.

Extra Credit.

Extra credit may be earned by responses in class or by an extra credit project.

For responses in class, the exchange rate from extra credit points to semester points is determined at the end of the semester, and the result is added to semester average as calculated above for the ultimate grade.

Extra credit projects must *always* be approved *in advance* and *in writing* by the instructor and *must* be approved *before* the last three weeks of the semester. Extra credit project points are stated directly in terms of semester points in the written approval and added to the semester average as calculated above.

Guidelines.

Individual Study Guideline. Unless specifically stated otherwise, assignments are to be done *individually*. Mild discussion of problems is permissible. Looking at someone else's solution while writing up your own solution is NOT permissible. Borrowing someone else's work, or lending your work to someone, is NOT permissible.

Academic Honesty Statement. The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at **www.ndsu.edu/academichonesty**

Special Needs Statement. Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor as soon as possible.

Military Needs Statement. Veterans and student soldiers with special circumstances or who are activated are encouraged to notify the instructor in advance.

Tentative outline.

The pace of the course will be approximately one section from Farlow (sections listed here) per lecture with some additional material from outside the text.

CHAPTER 1. Introduction.

(1) Introduction to partial differential equations.

CHAPTER 2. Diffusion-Type Problems.

(2) Diffusion-type problems (parabolic equations).
(3) Boundary conditions for diffusion-type problems.
(4) Derivation of the heat equation.
(5) Separation of variables.
(6) Transforming nonhomogeneous BCs into homogeneous ones.
(7) Solving more complicated problems by separation of variables.
(8) Transforming hard equations into easier ones.
(9) Solving nonhomogeneous PDSs (eigenfunction expansions).
(10) Integral transforms (sine and cosine transforms).
(11) The Fourier series and transform.
(12) The Fourier transform and its application to PDEs.
(13) The Laplace transform.
(14) Duhamel's Principle.
(15) The convection term u_x in diffusion problems.

CHAPTER 3. Hyperbolic-Type Problems.

(16) The one dimensional wave equation (hyperbolic equations).
(17) The D'Alembert solution of the wave equation.
(18) More on the D'Alembert solution.
(19) Boundary conditions associated with the wave equation.
(20) The finite vibrating string (standing waves).
(21) The vibrating beam (fourth-order PDE).
(22) Dimensionless problems.
(23) Classification of PDEs (canonical form of the hyperbolic equation).
(24) The wave equation in two and three dimensions (free space).
(25) The finite Fourier transforms (sine and cosine transforms).
(26) Superposition (the backbone of linear systems).
(27) First-order equations (method of characteristics).
(28) Nonlinear first-order equations (conservation equations).
(29) Systems of PDEs.
(30) The vibrating drumhead (wave equation in polar coordinates).

CHAPTER 4. Elliptic-Type Problems.

(31) The Laplacian (an intuitive description).
(32) General nature of boundary-value problems.
(33) Interior Dirichlet Problem for a circle.
(34) The Dirichlet Problem in an annulus.
(35) Laplace's Equation in spherical coordinates (spherical harmonics).
(36) A nonhomogeneous Dirichlet Problem (Green's Functions).