Department of Mathematics & Statistics
Concordia University

MATH 473 (MAST 666/MAST 841), Sec. A

Partial Differential Equations

Winter 2018

Course Instructor: Dr. J. Harnad, Office: LB 901-25 (SGW), Phone: 514-848-2424, Ext. 3242

Office Hours: Thursdays, 10:00-11:30 AM.

Prerequisites: **MATH 264/265** or an equivalent multivariable calculus course.
MAST 330 or an equivalent course in ordinary differential equations.

Text: *Basic Partial Differential Equation (International Press 1996 Edition or later* by *D. Bleeker and G. Csordas* (CRC ed.).

Assignments: Assignments are *very important* as they indicate the level of difficulty of the problems that the students are expected to solve and understand. Therefore, every effort should be made to do and understand them *independently*. The assignments will be corrected and a representative sample graded, with solution sets posted weekly. These grades together are worth a maximum of 10%.

Use of Computer Algebra System: It is optional but much recommended to install and use Maple or Mathematica. These computer tools can be used to verify and illustrate any analytical results you get while doing your assignment problems.

Calculators: Electronic communication devices (including cell phones) are not allowed in examination rooms. Only "Faculty Approved Calculators" (**SHARP EL-531** or **CASIO FX-300MS**) are allowed in examination rooms during mid-term and final.

Test: A midterm test covering the first seven weeks will be given in week 8, worth 30% of the total grade.

Final Grade: The highest of the following:

- 100% final exam.
- 30% midterm, 10% assignments, and 60% final exam.

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

Approximate schedule of topics

Week	Chapters	Topics	Assignments (Numbering: 9th edition)	Due date
1. Jan. 9, 11	2.	First Order PDE's: Linear PDE's, constant coefficients, variable coefficients; higher dimensions.		
2. Jan. 16, 18	3.	The heat equation in 1 D; uniqueness, maximum principle, boundary conditions	**1.**	Jan. 23 (assignment 1)
3. Jan. 23, 25	3.	The heat equation in 1 D boundary conditions: time dependent and independent	**2.**	Jan. 30 (assignment 2)
4. Jan. 30, Feb. 1	4.	Fourier series; orthogonality, Fourier series, convergence, Fejér's theorem	**3.**	Feb. 6 (assignment 3)
5. Feb. 6, 8	4.	Sine and cosine series; applications. Sturm-Liouville theory.:Eigenvalues, eigenfunctions, uniqueness, orthogonality, positivity, comparison theorem, applications to PDE's	**4.**	Feb. 13 (assignment 4)
6. Feb. 13, 15	5.	The wave equation in 1D. Separation of variables. Solution by Fourier series. D'Alembert's solution. General solution.	**5.**	Feb. 27 (assignment 5)
Midterm break		Midterm break		
7. Feb. 27, Mar. 1	5.	The wave equation in 1D. Boundary conditions; fixed or free ends; solution by Fourier series; Method of images.	**6.**	Mar. 8 (assignment 6)
8. Mar. 8	Midterm Mar. 8	Midterm test Mar. 8	Midterm test, closed book (Chapters 1-5)	Mar. 13

9. Mar. 13, 15	6.	Laplace's equation in 2D. applications, rotational invariance, boundary value problems (Dirichlet, Neumann); maximum principle i	**7.**	Mar. 20 (assignment 7)
10. Mar. 20, 22	6.	Laplace's equation in 2D. Polar coordinates; Dirichlet problem in annuli and disks, Poisson integral formula, regularity of harmonic functions	**8.**	Mar. 27 (assignment 9)
11. Mar. 27, 29	6.	Laplace's equation in 2D; complex variables, conjugate harmonic functions, conformal mapping	**9.**	Apr. 3 (assignment 9)
12. April 3, 5 13. April 10, 12	7.	Fourier transforms and complex Fourier series; properties of Fourier transforms; convolution products; inversion problem, Parsefal's equality; applications to PDE's; heat problems for finite and semi-infinite rods	**10.**	Apr. 10 (assignment 10)

Academic Integrity and the Academic Code of Conduct

This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: concordia.ca/students/academic-integrity." *[Undergraduate Calendar, Sec 17.10.2]*