Introduction to Partial Differential Equations with Numerical Methods

Math 478-001

Fall 2018

This is the web page **http://math.cos.gmu.edu/~wanner/courses/m478f18/index.html**. It will be updated regularly and always contain the latest information on the course. This website is only for general policies concerning the course, as well as for the continuously updated syllabus. For all other information on the course, including lecture notes and homework assignments, please go to Blackboard.

General Information:

Instructor:	Thomas Wanner
Office:	Exploratory Hall 4404
E-mail:	twanner@gmu.edu
Web Page:	http://math.cos.gmu.edu/~wanner/
Fax:	(703) 993-1491
Office hours:	M 2-3pm, W 3-4pm, and by appointment

Lectures:	MW 12:00-1:15pm, Robinson Hall B106
Prerequisites:	Grade C or better in MATH 203 and 214 or 216.
Textbook:	Book manuscript *Theory and Numerics of Partial Differential Equations* by E. Sander, T. Wanner (will be made available as PDF via Blackboard)

Important Links:

- Detailed syllabus
- Relevant official GMU policies

Additional course material can be found on the Blackboard site for this course. Please make sure to check there regularly!

Syllabus:

This course introduces basic facts about partial differential equations, including elliptic equations, parabolic equations and hyperbolic equations. We will discuss methods of solution such as separation of variables and

characteristics, as well as initial/boundary-value problems and numerical approximation techniques. A more detailed syllabus can be found here. It will be updated weekly.

Homework Assignments:

Homework problems will be assigned once a week and posted on Blackboard. Most of these assignments will be graded and count towards your homework score. While the remaining ones do not have to be handed in, I do advise everyone strongly to study them and write out the solutions properly. I will go through many of the homework problems in the following class and you will not benefit from this if you have not made a serious attempt at solving them.

Matlab:

The software package Matlab will be used throughout the course. Matlab is a computing environment with programming capability, good graphics, and powerful library functions. It is available on campus on the Mason cluster and several Unix computer labs. Alternatively, a PC or Macintosh version can be purchased at the bookstore. Many Matlab tutorials are available:

- A very good tutorial by Kermit Sigmon, University of Florida, in Postscript format. There is also an HTML version of this tutorial.
- The official Getting Started with Matlab guide from Mathworks in PDF format.
- You should also take a look at the tutorials of my colleague E. Sander.

Also, the manual which comes with the PC version is very complete. Further information on Matlab can be found here and here.

Grading Policy:

Your final grade in the course will be determined from your performance in the homework assignments, a midterm exam, a final project, and your attendance and class participation. Weights for these items will be distributed approximately according to the following schedule:

Homework	**Midterm Exam**	**Final Project**	**Attendance**
40%	25%	25%	10%

The assignment of your course grade is based on the total course score. The following grading scale may serve as a guideline, although changes are possible:

Score above	90%	80%	70%	60%	otherwise
Letter grade	A-, A, or A+	B-, B, or B+	C or C+	D	F

Thomas Wanner, August 17, 2018.

Introduction to Partial Differential Equations with Numerical Methods

Math 478-001

Fall 2018

The following table contains a preliminary schedule for the course. This page will be updated regularly throughout the semester. The section numbers in the last column refer to the textbook.

Week	Date		Sections
		I. Introduction to Differential Equations	
1	08/27	1. Ordinary and Partial Differential Equations	1.1.1, 1.1.2, 1.1.3
	08/29	2. Domains and Their Boundaries	1.1.4
2	09/05	3. The Heat Equation	1.2.1
		4. Laplace's Equation	1.2.2
		5. The Transport Equation	1.2.3
		6. The Wave Equation	1.2.4
		7. Classification of Partial Differential Equations	1.3.1, 1.3.2
		II. Separation of Variables	
		1. Orthogonal Functions	2.1.1
		2. Generalized Fourier Series Expansions	2.1.2
		3. Extensions to Higher Dimensions	2.1.3
		4. Sturm-Liouville Boundary Value Problems	2.2.1, 2.2.2, 2.2.3
		5. Separation of Variables I	2.3.1
		6. Separation of Variables II	2.3.2, 2.3.3
		7. Eigenvalue Problems	2.4
		8. Inhomogeneous Evolution Equations	2.5.1, 2.5.2
		III. Basic Numerical Techniques	
		IV. Linear Elliptic Equations	
		V. Nonlinear Elliptic Equations	
		VI. Parabolic Equations	
		VII. Hyperbolic Equations and Characteristics	

Thomas Wanner, August 17, 2018.

Relevant George Mason
Official University Policies

The following policies apply to all courses at George Mason University:

1. It is expected that each student will conduct himself or herself within the guidelines of the Honor Code. All academic work should be done with the level of honesty and integrity that this University demands.
2. You are responsible for the accuracy of your own schedule. Check Patriot Web regularly to verify that you are registered for the classes that you think you are. A student who is not registered may not continue to attend class. Faculty are not permitted to grade work of students who do not appear on the official class roster.
3. You are responsible for knowing the last days to drop and add this class.
4. Once the add and drop deadlines have passed, instructors do not have the authority to approve any requests from students to add or drop/withdraw late. It is NOT permissible to drop the class and leave it at that. It needs approval. Late adds (up until the last day of classes) must be reviewed and approved by the department chair of the course being offered. They will be approved only in the case of a documented university error (such as a problem with Financial Aid being processed). All student requests for withdrawals and retroactive adds (after the last day of classes) must be reviewed by the student's academic dean. In the case of students whose major is in COS, this is the office of Undergraduate Academic Affairs in Enterprise.
5. Instructors are required to give the final exam at the time and place published in the Schedule of Classes, as set by the Registrar. It cannot be changed. You need to plan vacation (make plane reservations, etc.) around these published dates.
6. Once final grades have been recorded, instructors cannot accept any work to change that course grade. Grade changes can only be approved when they are due to a calculation or recording error on the part of the instructor.
7. An IN (incomplete) grade is a very special grade that can only be applied for in writing. It can only be given in cases in which a student is passing a course and has a very limited amount of work left to complete the course.
8. Federal law (a law known as FERPA) requires the protection of privacy of student information. Therefore, no instructor on campus can speak about a student's record with anyone other than the student. The record includes how a student is doing in a course, whether a student has attended class, information about grades, whether a paper has been turned in. Anything. This prohibition includes parents, siblings, and spouses, anyone.
