

**Online Math 5397 – Fall 2020**  
**Partial Differential Equations**

**Instructor:** Jeff Morgan jjmorgan@central.uh.edu

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

**Course Site:** This course will be hosted on Space (<https://space.uh.edu>). You will be able to go to this site and access the course on August 24, 2020.

**Homework Assignments:** Written (typed or combined) assignments will be given every other week. These will be posted at least 10 days in advance, and students will upload their solutions in a single PDF file to the course site on Space.

**Online Fill In The Blank Quizzes:** These will be given on the weeks when no assignment is due. Students will only submit their answers, and they will immediately receive their grade. These quizzes can be attempted multiple times, up to the due date, and the highest grade will be used.

**Exams:** Students will take a 2 hour midterm and a 2 hour comprehensive final exam. Details will be given.

**Weekly Online Help Sessions:** Help sessions will be held online from 8-10pm on Thursdays. Information will be posted in the Calendar on Space. These sessions will be recorded and the video and notes will be posted.

**Face to Face Help Sessions:** For students in the Houston area, live help sessions will be offered on a weekly or bi-weekly basis, depending on demand.

**Course Material:** The primary goal of this course is to provide a conceptual introduction to the basic ideas encountered in partial

differential equations, the techniques for analyzing these equations, and the ideas associated with the context of physical applications. The secondary goal is to expose students to Matlab methods for approximating the solutions to Partial Differential Equations. Students are not expected to have any previous experience with Matlab, and the software is free for all UH students.

In addition to reading the text book, students will have access to weekly posted notes and videos associated with the course material.

### **Part 1**

1.1 Review of basic concepts in ordinary differential equations

1.2 General discussion of partial differential equations

1.3 Transport, waves, vibrations, and diffusion

1.4 Boundary value problems

1.5 The concept of well posedness

### **Part 2**

2.1 The Wave Equation on the whole line.

2.2 The Diffusion (or Heat) Equation on the whole real line.

2.3 The Maximum Principle

2.4 The Duhamel Principle for the Wave and Diffusion Equations

### **Part 3**

3.1 Separation of Variables 1-space dimension Diffusion Equation

3.2 Separation of Variables 1-space dimension Wave Equation

3.3 The Diffusion and Wave Equation on a Square.

3.4 More general 2 space dimension Problems

- 3.4 The Laplace Equation on a Disk.
- 3.5 The Laplace Equation on a Square
- 3.6 Approximating Solutions with Matlab

#### **Part 4**

- 4.1 Convergence of Series of Functions
- 4.2 Fourier Coefficients
- 4.3 Even and Odd Functions
- 4.4 Orthogonality and General Fourier Series
- 4.5 Completeness and the Gibbs Phenomena
- 4.6 Eigenvalue Problems in Higher Dimensions
- 4.7 Visualizing Convergence of Series of Functions in Matlab

#### **Grades:**

- **Forum:** 10% - Students will be expected to participate regularly in the discussion forum, and they will receive points for any posts that ask or answer questions associated with the course.
- **Quizzes:** 15% (explained above)
- **Assignments:** 15% (explained above)
- **Midterm Exam:** 30%
- **Final Exam:** 30%

Whenever possible, and in accordance with 504/ADA guidelines, we will attempt to provide reasonable academic accommodations to students who request and require them. Counseling and Psychological Services (CAPS) can help students who are having difficulties managing stress, adjusting to college, or feeling sad and hopeless. You can reach CAPS (<http://www.uh.edu/caps>) by calling 713-743-5454 during and after

business hours for routine appointments, if you or someone you know is in crisis. No appointment is necessary for the "Let's Talk" program ([http://www.uh.edu/caps/outreach/lets\\_talk.html](http://www.uh.edu/caps/outreach/lets_talk.html)), a drop-in consultation service at convenient locations, and hours around campus.