DIFFERENTIAL EQUATIONS 2
MATH 3420.002
SPRING 2015

Instructor: Dr. J. Iaia   Time: MWF 9:00-9:50
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Text: Boyce and DuPrima, *Elem. Diff. Eqns. and Bdy. Value Probs.*, 10th ed.

Prerequisite: Math 3410 - Differential Equations 1

GRADING POLICY

Homework	*Weekly*	20%	
Exam 1	*Feb.* 13	20%	
Exam 2	*Mar.* 13	20%	
Exam 3	*Apr.* 17	20%	
Final	*May* 13	20%	8:00-10:00

Exams: Exams **must** be taken on the dates listed above. Exceptions will be considered *only* if one has **written documentation** certifying one's absence.

Homework: Homework will be assigned each class and collected weekly. Five problems will be chosen at random and graded. Homework is extremely important and students are highly encouraged to spend a lot of time working on the homework problems.

Attendance: **Students are responsible** for **all** work assigned and announcements made during any absence.

Code of Conduct: Students are expected to be *respectful of others* at all times. This includes keeping talk and other noise to a minimum while a lecture is in progress or an exam is being taken. Any student being disruptive may be dismissed from the class meeting. **Cheating** will **not** be tolerated and anyone found guilty of cheating may receive an F for the semester.

The **Student Evaluation of Teaching Effectiveness (SETE)** is a requirement for all organized classes at UNT. This short survey will be made available to you at the end of the semester, providing you a chance to comment on how this class is taught. I am very interested in feedback from students, as I work to continually improve my teaching. I consider the SETE to be an important part of your participation in this class.

Students with disabilities: It is the responsibility of students with disabilities to provide the instructor with appropriate documentation from the Dean of Students Office.

Semester grades are determined by averaging the grades on the 3 exams, the final exam, and the homework. Letter grades will be based on this average and will follow this scheme:

A 90- ;B 80-89; C 70-79; D 60-69; F -59

Course Description

In this course we will discuss the solutions of the most well-known partial differential equations (PDEs) - the heat equation, wave equation, and laplace equation. We will solve these equations on intervals and rectangles by the method of separation of variables. We will also discuss Fourier series and see how these are used in solving many PDEs. We will also discuss the Fourier transform and the solution of the heat and wave equations on the entire real line. We will prove uniqueness of solutions for a wide variety of equations. We will discuss polar coordinates and use them to solve the laplace equation in a disk. If time permits we will study Bessel's equation and also first order linear equations.

Course Objectives

At the end of this course students should know how to calculate the Fourier series of a function and be able to use the separation of variables technique to solve various linear PDEs on intervals and rectangles. Students should also be able to calculate the Fourier transform of a function and use it to solve various linear PDEs on the real line. Also students will be able to rewrite the laplace equation in polar coordinates and be able to solve the laplace equation in a disk.

Course Outline

Meeting 1 - review of first order separable equations and second order equations with constant coefficients, introduction to and calculation of Fourier series

Meeting 2 - more Fourier series and introduction to the method of separation of variables to solve partial differential equations on an interval

Meeting 3 - use of separation of variables to solve the heat equation on an interval with various boundary conditions

Meeting 4 - use of separation of variables to solve the wave equation on an interval with various boundary conditions

Meeting 5 - use of separation of variables to solve the laplace equation on a rectangle with various boundary conditions

Meeting 6 - solving inhomogeneous equations

Meeting 7 - final comments from meetings 1-6 and review for exam 1

Meeting 8 - Exam 1

Meeting 9 - use of polar coordinates to rewrite and solve the laplace equation in a disk

Meeting 10 - use of polar coordinates to rewrite and solve the laplace equation in an annulus

Meeting 11 - proof of uniqueness of solutions of various linear PDEs on bounded sets

Meeting 12 - introduction to and the calculation of the Fourier transform of a function

Meeting 13 - introduction to and the calculation of the convolution of two functions

Meeting 14 - use of the Fourier transform and convolution to solve the heat equation and wave equation on the real line

Meeting 15 - final comments from meetings 9-14 and review for exam 2

Meeting 16 - Exam 2

Meeting 17 - more on the Fourier transform and convolution

Meeting 18 - solution of the heat equation and wave equation in a disk, Bessel's equation, Bessel functions

Meeting 19 - more on Bessel's equation and Bessel functions

Meeting 20 - proof of uniqueness of solutions of various linear PDEs on unbounded sets

Meeting 21 - first order linear PDEs

Meeting 22 - use of change of variables to solve first order linear PDEs

Meeting 23 - final comments from meetings 17-23 and review for the final exam

Meeting 24 - Exam 3

Meeting 25 - method of characteristics

Meeting 26 - solution of the heat, wave, and laplace equation in a ball

Meeting 27 - more on the solution of the heat, wave, and laplace equation in a ball

Meeting 28 - more on the solution of the heat, wave, and laplace equation in a ball

Meeting 29 - review for final exam

Meeting 30 - review for final exam

Meeting 31 - Final Exam