MATH 322/574 – PARTIAL DIFFERENTIAL EQUATIONS SYLLABUS – FALL 2021

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Lectures. Wednesday 14.40-16.30, Friday 11.40-12.30.

Course Description. Our understanding of the fundamental processes of the natural world is based to a large extent on partial differential equations. W. A. Strauss

Partial differential equations (PDEs) is a topic worthy of your study. It is a subject about differential equations involving unknown functions of several variables; the derivatives are partial derivatives. As such, it is a subject that is intimately connected with multivariable calculus. To be successful you should have a good command of the concepts in the calculus of several variables. So keep a calculus text nearby and review concepts when needed. The same comments apply to elementary ordinary differential equations (ODEs).

Prerequisite. Math 202

Learning Outcomes

Upon completion of this class, students should be able to:

- 1. Understand the basic types of problems PDE deals with.
- 2. Differentiate types of PDE's (hyperbolic, parabolic, etc)
- 3. Solve the basic equations.
- 4. Apply basic techniques of PDE to similar problems.
- 5. Use and understand the usage of Fourier series.
- 6. Understand (have a feel of) text dealing with more complicated equations

Recommended or required reading

Textbooks: Partial Differential Equations, An Introduction by W. Strauss We will cover the first six chapters from this book. Readings: A First Course in Partial Differential Equations by H.F. Weinberger

and all other Partial Differential Equations books.

You must try the problems at the end of each section in the book.

Exams and Homework. There will be three homework, one midterm and one oral exam, and **NO** final. **There is no make up for the exams. It is your responsibility to be present in the midterm.** Tentative dates of these exams are below. Midterm and oral exam will be on the last week of the semester.

Makeup Policy. There will be no makeup. Instead the least grade out of the one midterm/three homework will not be counted in your total grade evaluation.

Academic Honesty. Dishonesty includes cheating on a test, plagiarism, and helping another student cheat or plagiarize. Academic dishonesty will result in failure of the course. For complete information about the University's policy on Academic Honesty, please visit the web site: <u>http://www.sabanciuniv.edu/tr/yonetmelikler</u>

Attendance. Class attendance is mandatory. If you miss a class, it is your responsibility to make up the material.

Grading: There will be one midterm exam, three homework, each has 30% weight, one oral exam and no final. Formula to compute your total grade: Total= $0.30^{*}(M+H1+H2+H3-MIN(M,H1,H2,H3))+0.10^{*}OralExam$

The dates of the midterms may change!

| Midterm | 6 January 2021 | |
|------------|--------------------------------|-----|
| Homework 1 | Due: Nov 4 th 2020 | 90% |
| Homework 2 | Due: Dec 2 nd 2020 | |
| Homework 3 | Due: Dec 30 th 2020 | |
| Oral Exam | 8 January 2021 | 10% |

The grading scale is 90-100 A, 86-90 A-, 81-85 B+, 76-80 B, 70-75 B-, 66-69 C+, 63-65 C, 59-62 C-, 56-58 D+, 50-55 D, and below 50 F. Plus and minus grades will be given at my discretion.

Course Schedule:

| Dates | | | Exams |
|----------------|---------------|---|--------------|
| Oct 7-9 | 1.1, 1.2, 1.3 | First order linear PDEs and well-posed problems | |
| Oct 14-16 | 1.4, 1.5 | First order linear PDEs and well-posed problems | |
| Oct 21-23 | 1.6 | Classification of second-order linear PDEs | |
| Oct 28 | 2.1, 2.2 | Waves and reflections | |
| Nov 4-6 | 2.3, 2.4, 2.5 | Waves and reflections | HW1 |
| Nov 11-13 | 3.1, 3.2, 3.3 | Diffusions, comparison of waves and diffusions, sources | |
| Nov 18-20 | 3.4, 3.5 | Diffusions, comparison of waves and diffusions, sources | |
| Nov 25-27 | 6.1, 6.2 | Laplace equation, maximum principle, Poisson's formula | |
| Dec 2-4 | 6.3, 6.4 | Laplace equation, maximum principle, Poisson's formula | HW2 |
| Dec 9-11 | 4.1, 4.2, 4.3 | Boundary Problems: Separation of Variables | |
| Dec 16-18 | 5.1, 5.2 | Fourier Series; orthogonality, expansions, convergence | |
| Dec 23-25 | 5.3, 5.4 | Fourier Series; orthogonality, expansions, convergence | |
| Dec 30 | 5.5, 5.6 | Solution of basic boundary value problems by Fourier Series | HW3 |
| Jan 6 Jan 8 | | | M Oral Ex |

Add-drop: October 13-14

Withdrawal: November 16-December 4

Content of the midterm. Roughly the following topics will be the content of the exams.

| Midterm 6 | January 2021 | Wednesday (11.40-13.30) |
|------------------|--------------|--|
| 1.1, 1.2, 1.3, 1 | .4, 1.5, 1.6 | First order linear PDEs and well-posed problems, Classification of |
| second-order l | inear PDEs | |
| 6.1, 6.2, 6.3, 6 | .4 | Laplace equation, maximum principle, Poisson's formula |
| 4.1, 4.2, 4.3 | | Boundary Problems: Separation of Variables |
| 5.1, 5.2, 5.3, 5 | .4 | Fourier Series; orthogonality, expansions, convergence |

Oral Exam 8 January 2021 Friday (11.40-??)

In the oral exam you should expect conceptual questions (definitions, basic concepts, basic and important theorems, methods). Simple problems from midterm or homework with a minimum amount of computation will also be asked.

If you need extra help:

Always keep in mind that it is very natural and all right if you do not understand a concept or some thing in the lecture. I and teaching assistants are available to help. Ask questions. Benefit office hours.

- Regular study habits are sufficient to get a decent grade.
- Attend the classes and recitation hours regularly. Make sure you attend your own (registered) recitation section.
- Studying out of class for this course should become a routine. Key to success in mathematics is practice. **Solve many problems** related to each concept.
- You are responsible from every announcement made in class or in SUCourse. Not attending the class or not following SUCourse regularly is not an excuse, in case you miss something.
- I am available to help. Feel free to ask me and your TA a question in and out of class. If you cannot make it to our office hours, you should e-mail me (or your TA) ahead of time and make an appointment.

My weekly schedule

| | Mon | Tue | Wed | Thu | Fri |
|-------------|----------|-----|--------------|-----|--------------|
| 8.40-9.30 | | | | | |
| 9.40-10.30 | | | | | |
| 10.40-11.30 | | | | | |
| 11.40-12.30 | | | Math 603 | | Math 322/574 |
| 12.40-13.30 | | | Math 603 | | |
| 13.40-14.30 | Math 603 | | | | |
| 14.40-15.30 | | | Math 322/574 | | |
| 15.40-16.30 | | | Math 322/574 | | |