# PARTIAL DIFFERENTIAL EQUATIONS

## MATH 4710, CRN 30422, Spring 2023

http://faculty.weber.edu/aghoreishi/Math4710_s23/Math4710_s23.asp/

**Prerequisites:** Math 3710.

**Text:  Required:**     Applied Partial Differential Equations with Fourier Series and Boundary Value Problems by Richard Haberman, Prentice Hall, 4th Edition, 2004, ISBN 0-13-065243-1. (This is an old edition. You can find it as cheap as $10. Here are a couple of resources: Amazon.com and  https://www.gettextbooks.com/isbn/9780130652430/ .)

**Reference:**     Partial Differential Equations with Fourier Series and Bounday Value Problems by Nakhle H. Asmar, Dover
Introduction to Partial Differential Equations with Applications by E.C. Zachmanoglou and Dale W. Thoe, Dover.
Partial Differential Equations - An Introduction, Walter A. Strauss, Wiley.

**Class Meetings:** MWF 10:30-11:20, TY 449.

**Instructor Information:** Dr. Afshin Ghoreishi, http://faculty.weber.edu/aghoreishi/. Office: TY 450M. Office Hours:  M 9:30-10:20, 12:30-1:20, T 9:30-10:20 , 10:30-11:20, W 9:30-10:20, and F 9:30-10:20. At other times, you can see me whenever I am in my office and not busy. You can also see me by making an appointment.

**Procedures:** During the course, we will review all necessary background material from the pre-requisite course: Math 3710, Boundary Value Problems.  You are encouraged and expected to read the book on your own. I will try to answer questions in class, but since this time will be limited I encourage you to utilize office hours.

We will have weekly homework, two exams and a final exam. **Do not enter the class late & do not come to class if you have to leave early. Turn off pagers, cell phones and other such disruptive devices. Do not text message.** Failure to follow these basic courtesies may result in a failing grade. **Excessive absences** (more than 5) **will  result in a grade of UW.**

Note: The university administration has reduced the length of the spring semester by 4 days. I will do my best to still devote adequate time to all topics, questions and reviews.

**Homework:** A problem list is included. To be successful in this class you should be able to solve all problems. Each Friday I will hand out a homework sheet consisting of about 10 problems and many from the book problem list. Homework will be due the following Wednesday with the grace period until  **Friday at the start of the class**. The latest time I will accept homework is Friday at 10:30. **No late homework will be accepted.**

Do not solve problems side-by-side, write only on one side of each page and staple your homework. Write your name on the top center position of  front page and number your pages as, for example; 1/7, 2/7, ... , 7/7 (if there are a total of 7 pages), on the top right hand corner of each page. **No** late homework will be accepted.

**Mathematics Mondays:** The Mathematics Department offers you the unique opportunity to form a community of students and faculty, through weekly events on Mondays at 1:30 in TY 365. These events are free and open to all and include study sessions, puzzles and games, solving problems posed in mathematics journals, mathematics research, and talks by students, faculty and invited guests.  Your level of participation is entirely up to you; from an interested observer, presenter of solutions to journal problems or interesting papers, to mathematics researcher. You can even earn credit through courses Math 2925/4925. Make Mathematics Mondays part of your weekly schedule for fun and enhancing the success of your post graduate plans.

**Extra Credit:** You can earn extra credit by correctly solving and submitting your solution to problems posted in mathematics journals. You can find these in the Spring 2023 folder in the shared P, J & R Directory, a Google Drive. You can also post your solutions there and work jointly together or with me. You may also earn extra credit by making a presentation to the Math Factor. **These can be facilitated by attending the weekly meetings of Math Factor or taking the one credit hour course Math 2925, both meeting Mondays at 1:30 in TY 365.** The following are the talks of special interest for this class.

1.     Proof of Convergence of Fourier Series  - Write up and present the proof of convergence of Fourier series to the Math f(a)ctor.  Reference: Course Textbook, BVP's and PDE's, David Powers, 6th edition, ISBN 978-0-12-374719-8.

2.     Presentation of the calculus based proof of $\frac{1}{1} + \frac{1}{4} + \frac{1}{9} + \cdots = \frac{\pi^2}{6}$ . You learned in Calculus II that this infinite

series is convergent ( $p$  -series wi $p = 2 > 1$ ). In this class we will use Fourier series to find its value. But this can be done elegantly using calculus and is included in the book *Proofs from THE BOOK* by Martin Aigner and Gunte Ziegler, available in the library. Also, the paper http://math.cmu.edu/~bwsulliv/basel-problem.pdf lists several solutions with references.

3.     Solve and submit your solution to any problem posted in certain mathematics journals. I will hand out these problems.

**Exams:** Exams I & II will be administered at the Tracy Hall Testing Center. You may use electronic calculators in the exams. Exams can be taken anytime during the time periods listed below. **No** make-up exam will be given.

| | |
|---|---|
| Exam I | Feb  28 - Mar 1 |
| Exam II | Apr  11 - 12 |
| Final Project | Hand Out: April 24, Due Date: **April 26, 11:00 am** |

The Testing Center is located in the Tracy Hall, Rm. 101C, and will be open M-R 8:30 am - 8:00 pm, F 8:30 am - 4:30 pm, Sat 10:00 am - 4:30 pm. You must complete an exam by one hour after their closing time. You must also take along a picture I.D. **We will meet for our regular lectures during exam days.**

**Grading:** You will be given the opportunity to replace your lowest homework grade with your grade on a special assignment at the end of the semester.  Exams will be curved as needed, but a minimum standard will be retained regardless of the class performance.

| | |
|---|---|
| Exam I | 100 points |
| Exam II | 100 |
| Homework | 100 |
| Final Exam | 100 |
| *Extra Credit (optional)* | *up to 20 points* |
| ---------------------- | |
| Total | 400 points |

**Extra Help:**     **Mathematics Students' Room:** The code to TY 231, Mathematics Students's Room, is 654321. You will find the manuals mentioned above in that room.

**Other Important Dates:**

| | | |
|---|---|---|
| Martin Luther King Holiday | Jan | 16 |
| Last day to cancel a class | Jan | 30 |
| Presidents' Day Holiday | Feb | 20 |
| "Spring" Break | Mar | 6-10 |
| Last day to drop with a grade of W | Mar | 28 |

If you decide to drop this class, please inform me of your decision.

| Course Coverage and Problem List for Math 4710 | | | | | |
|---|---|---|---|---|---|
| Some sections are review from Math 3710 (This list may be adjusted as needed.) | | | | | |
| **Section** | **Problems** | **Section** | **Problems** | **Section** | **Problems** |
| Classification and transformation (not in the textbook) of PDE's. | | | | 12.1 | |
| 12.2 | 1-10 | 12.3 | 1-6 | 12.4 | 1-8 |
| 12.5 | 1-4 | 12.6 | 1-3, 6, 7, 17, 19 | 8.1 | |
| 8.2 | 1-6 | | | | |
| 2.3 | 3 | 2.4 | 1-3 | 2.5 | 1, 3-9, 10-14 |
| 3.2 | 2 | 3.3 | 2, 5 | 5.8 | 1 |
| 4.4 | 3(b), 4 | 7.2 | 2, 3 | 7.3 | 1-4 |
| 5.3 | 5-9 | 7.4 | 1 | 5.5 | 1, 3 |
| 7.5 | 1(a), 2, 3, 7(b), 8(a) | 7.6 | 1 | 8.3 | 1-3 |
| 8.4 | 1-4 | 8.5 | 1-6 | 8.6 | 1-9 |
| 7.7 | 1-10, 12 | 7.8 | 1-5 | 7.9 | 1-5 |
| 7.10 | 1-7, 9, 10 | 9.1 | | 9.2 | 1-4 |
| 9.3 | 1-12, 21, 22 | 9.4 | 1-8 | 9.5 | 1-7, 14, 16, 18, 19 |
| 10.1 | | 10.2 | 1, 2 | 10.3 | 1-18 |
| 10.4 | 1-11 | 10.5 | 1-19 | 10.6 | 1-20 |
| 11.1 | | 11.2 | 1-12 | 11.3 | 1-3, 5 |