Syllabus

MATH 5510, Section 101, Spring 2021
Linear Algebra & Matrix Theory
MWF 11:00AM–11:50AM Johnston Hall 415

Instructor: Dr. Ahmed Kaffel

 Email: ahmed.kaffel@marquette.edu, *Office*: Cudahy Hall, Room 360, *Phone*: 414-288–2804

Office Hours: MWF 3:00pm – 3:50pm, and by appointment (by using Microsoft teams).

I will hold regular remote office hours via Microsoft teams throughout the semester. Whenever you have a question (even a homework question!) or need assistance in the course, you should reach out to me right away. You should also always feel free to send me an email when you have a question about the course or the material.

If the question cannot be answered over email, you might be instructed to set up an appointment.

Course material text:
Applied Partial Differential Equations with Fourier Series and Boundary Value Problems
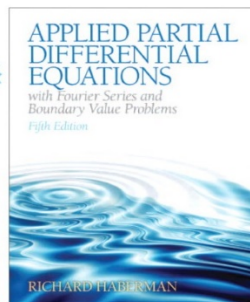
Please note that we will use the fifth edition. The fourth edition is also acceptable, but be aware that homework assignments will be made from the fifth edition. We will try to catch any changes in the assigned homework problems.
For supplementary and additional reading I recommend the following (non-required) textbooks:

- Solution Techniques for Elementary Partial Differential Equations, by C. Constanda.
- Partial Differential Equations, by W. Strauss
- Partial Differential Equations - An Introduction to Theory and Applications, by M. Shearer and R. Levy

   The textbook by C. Constanda has a strong problem-solving orientation (i.e. many worked examples), while the books by Strauss and Shearer-Levy are more theoretical (beautifully written) introductions to partial differential equations.

Prerequesite: MATH 2100, MATH 2105, MATH 2350, or MATH 2451.

Course Description and learning objectives: Partial Differential Equations (PDEs) model a wide variety of phenomena in the natural sciences, engineering, and economics. This course is an introduction to the theory of linear partial differential equations, with an emphasis on solution techniques and understanding the properties of the solutions thus obtained. Specific types of solution techniques that the student will acquire include separation of variables, Fourier methods, Green's functions, and the method of characteristics. Classification of PDEs and differences between properties of solutions of PDEs in various classes will also be an important theme in the course.

Recommended Equipment: A graphing calculator is recommended for this course. Calculators and/or computer software will generally be allowed on homework assignments, but are not permitted during exams.

Homework assignments: Homework assignments and due dates will be posted in the homework section below and/or D2L, usually sometime on Friday. Unless otherwise noted, please submit your homework assignments in the Dropbox on the due date. Late homework will not be accepted except in cases of excused absences (see "Attendance" below). However, your lowest homework score will be dropped from the final grade calculation.

In order to master the material of the course, it is key that you do your homework. You should make every effort to solve the assigned problems using the concepts learned from the lectures and readings. You will be graded mostly on your ability to work problems on exams. If you have not practiced the techniques within the homework problems, you will have serious difficulties to work problems on exams. You are strongly encouraged to do your homework in groups. However, you must write up your solutions on your own. Copying is not acceptable.

I strongly recommend neatly writing up solutions to the homework and saving these solutions. These solutions will be a valuable resource when you come to office hours or review for an Exam. Problems like the homework will appear on exams.
Please write your name at the top. Write legibly. Your solutions to the assigned problems should be detailed enough so that the reader can follow your thought process. Students asking for makeup exams or extensions of written homework due dates should let me know of any conflicts at least one week beforehand in the case of prescheduled absences and as soon as possible (but in no case more than two working days after the absence) in cases where the absence is not foreseeable.

Exams: There will be two midterm exams and a final exam:
1st midterm exam: Friday, March 5, 2021
2nd midterm exam: Friday, April 9, 2021
Final exam: May 10 2021, 1:00PM - 3:00PM

The exam problems are based on the lectures, the textbook, homework problems, and activities. An absence from an exam is recorded as a score of 0. Makeup exams are generally allowed only for university-excused absences. See "Attendance Policy" below. If you feel that your situation

warrants a makeup exam, please check with me as soon as possible to request one. Further documentation of your absence may be required.

Make-up exams will not be given unless there are extreme circumstances and you inform me of the absence within 48 hours of the exam. You are responsible for scheduling your make-up exam.

Final Exam: There will be a comprehensive final exam grade will be counted as 30% of your final grade. The final exam will be on **Monday 05/10/2021** from 1:00PM - 3:00PM.

Grading policy and Evaluation Criteria:

Your final grade will be determined as follows:
Homework: 30%
Midterm exams: 20% each
Final exam: 30%

Your final grade will be A, A-, B+, B, B-, C+, C, C-, D+, and D for course averages of 92%, 88%, 84%, 80%, 76%. 72%, 68%, 64%, 60% and 56%.

Grades for assignments and exams will be posted on D2L. Please check your recorded grades regularly to monitor your progress in the course and to ensure accuracy of recorded grades.

If you believe that an exam or a homework was graded or tallied incorrectly you may submit the exam for a regrade along with a separate sheet of paper explaining why you believe you deserve more points.

Grade Corrections: If you believe that an exam or a homework was graded or tallied incorrectly you may submit the exam for a regrade along with explaining why you believe you deserve more points. Regrades will be accepted up to two class periods after the exam or the homework grade is posted. You must let me know (in writing; email is fine) within seven days of receiving the grade; otherwise, I can't promise that I will consider the issue.

Important dates:
Exam 1 date**: *Friday, 03/05/2021***
*Exam 2 date: **Friday, 04/09/2021***
Final exam date: **Monday 05/10/2021** from 1:00PM - 3:00PM.
Classes resume: Jan 25, 2021
Classes end: May 8, 2021

Withdrawal from Course: If you intend to withdraw, it is your responsibility to withdraw yourself from the course before the due date. Do not assume that just because you have stopped attending class you will be automatically withdraw from the course. If you quit attending and not officially withdraw, you could receive a grade of F.

Special Statement on COVID-19
Marquette University recognizes that this is a difficult time which may be filled with uncertainty as we move forward with the academic year. Your safety, health, and well-being, as well as that

of our faculty and staff are our primary concern and we want to be able to support you in any way that we can. We ask that you adjust your behavior to best keep yourself and others safe. We have expectations that you act responsibly in order to mitigate risk to others. As your faculty, I too am committing to these behaviors that I will ask you to follow.

The University understands that at this time you may be facing some obstacles that would make it difficult to meet your academic goals. Please use the Student Resources page on the Marquette COVID-19 Response webpage for information and resources on basic needs such as housing, food, financial aid, and medical and mental health. The webpage also offers information on official University communications, access to technology, and student services. Your professors and advisors are also here for you. Visit the Marquette COVID-19 Response Page regularly as information may change as the semester rolls out.

Remember, you are not alone and together we will navigate these extraordinary and challenging times. We are Marquette!

Commitment to Inclusion and Equity
I would like to create a learning environment for my students that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality, religion, ability, etc.). I also understand that the current crisis of COVID, economic disparity, and health concerns could impact the conditions necessary for you to succeed. My commitment is to be there for you and help you meet the learning objectives of this course. I do this to demonstrate my commitment to you and to the mission of Marquette to be people for and with others and to care for the whole student (Cura Personalis). If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me. I want to be a resource for you (Marquette can provide financial assistance, food assistance, computers, and counseling services, and provide a specific request if you complete a Concern and Care Form).

Health-related Class Absences
Please regularly evaluate your own health according to current CDC, State of Wisconsin, and city guidelines. Do not attend class or other on-campus events if you are ill.

You are encouraged to seek appropriate medical attention for treatment of illness from Student Health Services. In the event of having a contagious illness such as influenza or COVID-19, please complete the voluntary form upon diagnosis and do not come to class or to campus to turn in any work. Instead, email me about your absence as soon as you are able so that appropriate accommodations can be explored.

Please note that documentation (a Doctor's note) for medical absences is not required. As part of their commitment to maintain confidentiality, to encourage more appropriate use of healthcare staff resources, and to support meaningful dialogue between instructors and students, Marquette Student Health Services will not provide documentation of illness.

I am committed to working with students with pre-existing medical and mental health needs, as well as new needs that may arise within the semester. I encourage you to reach out to me as early as possible to discuss any adjustments you think may be necessary in this course. Reasonable accommodations may include leveraging the course modules that have been developed in creative

ways to maximize your access during times when students need to quarantine due to COVID exposure, or during an absence related to a disability or COVID-19 diagnosis. While I cannot guarantee any specific outcome, I am committed to working with you to explore all the options available in this course. To begin this process, contact the Office of Disability Services (ODS).

- Confirmed COVID-19 diagnosis and in isolation: student is expected to participate in all assignments to the extent possible based on severity of symptoms. *Students are expected to inform instructor of quarantine or isolation dates and to communicate regularly about their ability to participate during that time*. Medical documentation is NOT required for return to the classroom but may be required for return to some clinical sites. Students need to contact Office of Disability Services in the event they are not able to participate in coursework due to COVID-19 or symptoms of COVID-19 to explore if a reasonable accommodation can be afforded.
- Symptomatic in isolation and needs testing or awaiting results: student is expected to participate in all assignments to the extent possible based on severity of symptoms and seek out COVID-19 test through the Marquette University Medical Clinic [414-288-7184]. Same guidance as above for documentation and accommodation.
- Confirmed COVID-19 exposure and in quarantine: Student is expected to participate in all assignments. Should symptoms develop students should seek out COVID-19 testing through the Marquette University Medical Clinic [414-288-7184]. Same guidance as above for documentation and accommodations.
- For all isolation or quarantine: Student is expected to contact the instructor to indicate student's inability to join and participate.

Note1: consistent with the current attendance policy and medical excuse policy (https://www.marquette.edu/medical-clinic/rights-policies.php), the Marquette University Medical Clinic does not provide medical excuses for short-term absences that result in missed classes, exams, or assignments due to illness or injury. Requiring medical excuses places an additional burden on healthcare systems and diverts resources from patient care. Quarantine/isolation does not require formal certification by healthcare provider.

Note2: "exposed and in quarantine" vs "diagnosed and in isolation," is distinct based on a few things. Those in quarantine will be out of class for a finite 14 days (unless they become symptomatic). Also, those in quarantine can leave their residence for essentials such as picking up food or medicine, etc., while those in isolation cannot leave their residence during isolation. Also time in isolation is variable, the least amount of time is 10 days but could be longer such as 2-4 weeks as it is based on when their symptoms resolve. The other difference is those in quarantine are not ill and can perform all work assignments remotely, while those that are sick may not be able to keep up depending on how sick they are.

Attendance
Our class meets remotely on MWF, *11:00am–11:50 a.m.* **Attendance is required.** Attendance is essential to succeed in this course. Missing class almost always results in poorer performance on tests and homework. Absences prevent you from getting the full benefit of the course, generally resulting in lower scores. If absent, you are responsible for all material missed due to that absence. You are expected to attend class on time with the appropriate lecture notes for the class, having

completed the assigned reading for the current lecture and assigned problems for the previous lecture. You are expected to join the class on time, stay through the entire lecture, be prepared to ask questions, and be willing to learn mathematics. The attendance policy of this course follows the College of Arts and Sciences policy in the Undergraduate Bulletin.
http://bulletin.marquette.edu/undergrad/academicregulations/#attendance
Specifically:

- Attendance will be taken in every class. If you have a good reason to miss a class, please inform the instructor as soon as possible (preferably via email) to mitigate penalties.
- The university attendance policy considers more than 6 or 7 absences to be excessive. With 8 absences you may lose a full letter grade and you may be dropped from the class. The University does not make a distinction between excused and unexcused absences. Excused absences related to COVID-19 and/or medical emergencies will be waived.
- If you miss a class, it is your responsibility to obtain and learn the material you missed. In the event that you miss a class I will be happy to answer your questions about the missed class *only* after you have obtained the material you missed (e.g., from another student) and made an attempt to learn it yourself (or with a tutor).

Participation

Class participation and active learning are important aspects of this class, so your engagement is critical to your success regardless of modality/delivery. However, I understand that sometimes you must miss examinations or other academic obligations affecting your grades because of illness, personal crises, and other emergencies. As long as such absences are not excessive (no more than a total of 8 absences per semester), I will work with you as best I can to help you succeed in the course. Please contact me as soon as possible when such absences arise so we can make arrangements to get you caught up. This policy will not apply in the case on non-emergency absences. All students who participate in class will receive extra credit points for *(*correctly*)* answering *specific* extra credit questions. Do not miss this opportunity to improve your grade.

Technology Requirements:
To be successful in this course, you will need to have foundational experience with D2L, the University's Learning Management System, and the videoconferencing tool Microsoft Teams. If you're not familiar with these technologies, review the [D2L Student Help resources](#) and [Students Use Microsoft Teams for online/live classes webpage](#).

I recommend you also visit the [Technology for Remote Learning webpage](#) for information on the technology you will need to be successful. For general questions about technology, contact the ITS Help Desk at [helpdesk@mu.edu](#) or 414-288-7799.

Academic honesty policy:

Academic dishonesty will not be tolerated. Here is the Honor Pledge: I recognize the importance of personal integrity in all aspects of life and work. I commit myself to truthfulness, honor, and responsibility, by which I earn the respect of others. I support the development of good character,

and commit myself to uphold the highest standards of academic integrity as an important aspect of personal integrity. My commitment obliges me to conduct myself according to the Marquette University Honor Code.

See the Undergraduate Bulletin for the approved University Academic policy. The University's policy is at http://bulletin.marquette.edu/undergrad/academicregulations/. Your program or college may have more strict regulations so please address each below accordingly. Love of truth is at the center of the university's enterprise, and academic honesty, in all its forms, is an explicit value of the university. The development and practice of academic honesty and integrity, both inside and outside of the classroom, are expectations for all members of the university community. Acts of academic dishonesty include, but are not limited to:

- The illegitimate use of materials (electronic devices, crib sheets, or phones, etc.) in any from during a quiz or examination.
- Asking someone to provide you with the answers, or the step-by-step instructions for completing exams or quizzes. Copying answers from the examination paper of another student.

- Obtaining, through theft, bribery, or collision, or otherwise improperly securing an examination paper prior to the time and date for the administration of the examination. Also, use of an examination paper previously administrated (e.g., during an earlier term) without the consent of the instructor who authored the examination is considered an act of academic dishonesty.
- Communicating examination answers with other students during an examination.
- Impersonating a candidate at an examination or availing oneself of such an impersonation.
- Tempering with an examination after it has been corrected and then returning it for more credit. Aiding or abetting any such offenses.
- Copying material from a Web page and submitting it as one's own work.
- Copying answers from the quiz or examination paper of another student.
- Plagiarizing (submitting the work of another as one's own ideas) or falsifying materials or information used in the completion of any assignment, which is graded or evaluated as the student's individual effort.
- Intentionally interfering with any person's scholastic work (e.g., by damaging or stealing laboratory experiments, computer files or library materials).
- Using another student's clicker in class or handing your clicker to another student to have them answer for you.

Other than possibly calculators, no electronic devices may be operated during the course of any exam or assignment without the explicit consent of the instructor. Instances of academic dishonesty will be handled in accordance with College policy and may lead to expulsion from the University. Academic Dishonesty is not tolerated at Marquette University. If you observe any misconduct it is your duty to report to the professor. If I find any misconduct it is my duty to report it to the Academic Integrity Council. Please refer to Marquette University's Academic Honesty Policy at http://marquette.edu/rc/academichonesty.shtml.

Ethics and Behavior: High standards of personal conduct and consideration of others are required in order to create a classroom climate conductive to learning. Disruptive behavior will not be

tolerated. Norms for classroom conduct are based on respect for the instructor and the fellow students. Behavior such as texting, updating social media, playing games, or otherwise distracting fellow students is inappropriate.

Academic Support: It is your responsibility to keep abreast of the course, to master the material covered, and to take the initiative for getting the help you need. You are encouraged to obtain help from the course instructor. However, if you miss a class, you are responsible for the missed materials. The MUSC Tutorial Program offers tutorial. For more information see the MUSG website at http://www.mu.edu/oses/ .

Disability: If you have a disability and require accommodations, please contact me early in the semester so that your learning needs may be appropriately met. You will need to provide documentation of your disability to the Office of Disability Services. If you are unsure of what you need to qualify for services, visit the Office of Disability Service's website or call the Office of Disability Services at 414-288-1645. The office of Disability Services is also prepared to help students process accommodation requests based on medical or personal needs related to COVID-19. Please contact ODS@marquette.edu as soon as possible if you feel you may need to explore modifications related to a disability or COVID-19, even if that need may not be immediate.

Communication standards
Marquette University's policy on email: "E-mail is an appropriate and preferred method for official communication by Marquette with students unless otherwise prohibited by law. The university has the right to send official communication to students by e-mail with the assumption that students will receive, read and, if necessary, act in a timely manner based upon these e-mails."
If I need to contact you outside of class, I will use your Marquette email address, and expect that you will read and respond to this communication in a timely manner. Additionally, please recognize standard email etiquette. Initial emails to me should contain (minimally) a subject, greeting and closing.
I will attempt to respond to students within 24 hours. If you have not received a reply from me within 24 hours, please resend the email.

Since this is a fully online course, your communications with me and other students are critical to your learning experience. Please be respectful to others as you communicate. In addition to Netiquette at Marquette policy, I would like to ask you to be cautious of dominating any discussion, keep an open mind and be sure to proof read and edit prior to publishing anything to D2L.

Subject to Change Clause: This syllabus is subject to change at the discretion of the instructor to accommodate instructional and/or student needs. Such change will be announced to the class at the appropriate time.

Partial Differential Equations

Course Outlines

Course contents: The table below lists the main textbook sections and topics to be covered in class.

Course Content		
Week	**Topics**	**Chapter in Textbook (handouts)**
1	Introduction to partial differential equations (PDE). Heat equation in one-dimension. Boundary Conditions Classification of PDE.	Chapter 1
2	Chapter 2: Method of Separation of variables. Linearity.	Chapter 1 Chapter 2
3	Heat equation with zero temperatures at finite ends Worked examples with the heat equation.	Chapter 2
4	Laplace's equation: Solutions and qualitative properties Chapter 3: Fourier Series.	Chapter 3
5	Fourier Cosine and Sine series Term by term differentiation of Fourier series. Term by term integration of Fourier series.	Chapter 3
6	Chapter 5: Sturm-Liouville eigenvalue problems Inhomogeneous problems	Chapter 8
7	Wave equation	Chapter 4
8	Higher dimensional PDEs	Chapter 7
9	Chapter 10: Infinite domain problems-Fourier transform solutions of partial differential equations. Introduction Heat equation on an infinite domain Fourier transform and the heat equation	Chapter 10
10	Fourier transform and the heat equation	Chapter 10
11	Chapter 5: Sturm-Liouville eigenvalue problems Introduction.	Chapter 5

	Examples. Sturm-Liouville eigenvalue problems.	
8	Vibrating Rectangular Membrane Vibrating Circular Membrane Chapter 8: Nonhomogeneous problems Introduction	Chapter 6
9	Heat flow with sources and nonhomogeneous boundary conditions Method of eigenfunction expansion with homogeneous boundary conditions	Chapter 6
10	Chapter 13: A Brief Introduction to Laplace Transform Elementary Properties of the Laplace Transform	Chapter 13
12	Fourier sine and cosine transforms Worked examples using transforms	Chapter 10
13	Classification of Second Order PDEs Canonical Form of the Hyperbolic Equation	
14	Chapter 12: The method of Characteristics for linear and quasi-linear wave equations Introduction Characteristics for first-order wave equations	Chapter 12
15	Examples-Method of Characteristics for the One-Dimensional Wave Equation	Chapter 12
16	Method of Characteristics for Quasi-linear Partial Differential Equation Systems of Partial Differential Equations	Chapter 12