Department of Mathematics, University of Utah

Partial Differential Equations for Engineering Students
MATH 3150 – Section 002 – Spring 2021
Course Information and Syllabus

Updated January 21, 2021

Instructor:	Akil Narayan
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Office:	WEB 4666, LCB 116

Office hours:	Monday 11am-noon, Thursday 3pm-4pm
Office hours location:	Virtual (zoom, same link as for class)

Class type: IVC (synchronous online)

Class time and location: TTh, 9:10am-10:30am, Zoom

Attendance policy: Attendance during synchronous lectures is *not* a part of your grade. However, I strongly recommend that you attend the synchronous Zoom lectures. Recordings of the lectures will be made available on Canvas.

Section webpage: http://www.sci.utah.edu/~akil/math3150
Note: Scores for graded assignments and recorded video lectures will be posted on Canvas.

Course Information: This is a 2-credit course.

Learning objectives: Upon successful completion of this course, a student should be able to:

- understand and practice modeling of classical physics problems leading to partial differential equations (PDE)
- identify and classify spatial and temporal PDE
- represent functions via Fourier series respresentations, and understand concepts related to convergence
- use separation-of-variables methods to solve PDEs over tensorial domains
- understand and use Fourier transforms for PDEs on infinite domains

Technical requirements: Due to both the technical content of this course and the special nature of this semester, the following technology access is **required**:

- access to a computer with Internet access (on which the below software can be used)
- the Zoom software, preferably with a working microphone and video camera (for access to synchronous class lectures and office hours)
- a relatively modern web browser (for access to the class website and to Canvas)

If you anticipate that access to this requisite technology will be a problem, please contact me ASAP.

Prerequisites: ODE and linear algebra (MATH 2250, or MATH 2270 and MATH2280), and multivariable calculus (MATH 2210 or MATH 1260 or MATH 1280 or MATH 1321).

Course description: Fourier series and boundary-value problems for the wave, heat, and Laplace equations, separation of variables in rectangular and radial geometries, Fourier transform.

Text: Required: *Partial Differential Equations with Fourier Series Boundary Value Problems* (5th edition), Richard Haberman, Pearson, 2019, ISBN 9780134995434. We will be using chapters 1-4 and 10 of this text.

If you do nothing, you will be charged for access to this textbook via the Inclusive Access program on Canvas. If you wish to exercise your right to gain access to the book in a different way, you need to opt-out of the Inclusive Access program. Please see either the Canvas or the course website for details on how to opt out. Access to the textbook will be available in the "Bookshelf" tab on Canvas starting January 18 (for those enrolled in Inclusive Access).
Class lectures will be *heavily* based on textbook material. The textbook provides additional details and alternative interpretations that cannot be covered in class due to time constraints. Homework will be assigned from problems in the textbook. Access to the textbook is mandatory for success in this class.

Class meetings: This class meets virtually and synchronously via Zoom 2 times per week. Class meetings will primarily be lecture-based, which will include a discussion of theory and practice examples. Video recordings of the lectures will be uploaded on Canvas.

Homework: Problem sets will be announced in-class and subsequently posted on the course website and on Canvas. Homework will be divided into weekly assignments and collected electronically via Canvas upload. Homework assignments are due on Tuesdays. Late homework assignments will be accepted, but with a 10% penalty per day late. This penalty will be automatically enforced on Canvas, and can be waived if you provide me documentation demonstrating extenuating circumstances.

Each homework assignment is worth equal weight and your lowest homework score over the semester will be dropped. You are welcome (and encouraged) to work on the homework assignment in groups, but each student must submit individual work.

Quizzes: Each week, a short 10 minute quiz will be given electronically via Canvas. You will be able to take the quiz any time during a 48-hour period on Canvas from Tuesday morning until Wednesday night, but once you start each quiz, you will only have 10 minutes to complete it. Quizzes are meant to reinforce overarching concepts and emphasize understanding of principles rather than mathematical computation.

Each quiz is worth equal weight, and over the course of the semester, your lowest two quiz scores will be dropped.

Exams: This course will have 2 "in-class" (proctored virtually during class time) midterm exams, in addition to 1 "in-class" (again, virtual) comprehensive final exam. All exams are written exams that will be proctored virtually with submissions taken electronically over Canvas. Details of this will be provided closer to the exam dates.

The midterm exams will be held in class on Thursdays, February 25 and April 1.

The final exam is a cumulative exam in the same format as the midterm exams. The final exam will be held on Wednesday, May 5 from 8:00-10:00am.

Unless otherwise specified, **neither calculators nor notes of any kind are allowed on any of the exams or quizzes**.

Grading: Your course grade will be computed as follows.

- Homework 35%
- Quizzes 10%
- Midterm exams ..... 2 x 15%
- Final exam 25%

Final letter grades will be assigned based on the following scheme:

- 92% - 100% — A
- 90% - 91% — A−
- 88% - 89% — B+
- 82% - 87% — B
- 80% - 81% — B−
- 78% - 79% — C+
- 72% - 77% — C
- 70% - 71% — C−
- 68% - 69% — D+
- 62% - 67% — D
- 60% - 61% — D−
- 0% - 59% — E

Important dates:

Jan 29		Last day to add, drop, or audit classes
Feb 25		Midterm 1
Mar 12		Last day to withdraw from classes
Apr 1		Midterm 2
Apr 9		Last day to elect CR/NC option
Apr 23		Last day to reverse CR/NC option
Apr 28		Reading Day
May 5	**8:00am**	Final exam

Tutoring: The Department of Mathematics provides free tutoring services through the Tutoring Center for many 1000-level, 2000-level, and for some 3000-level courses. The Tutoring Center provides services for MATH 3150, and is located in room 155 of the T. Benny Rushing Mathematics Center, between buildings JWB and LCB. Please see `https://www.math.utah.edu/undergrad/mathcenter.php` for attending information about the Tutoring Center and for hours of operation.

Class communication: An email list is set up with which I shall send out information not communicated during class. This email list will also be used to communicate class information in the case of unusual circumstances affecting the the logistics of the class. If you are not officially registered for the class but wish to be on the roster, please discuss it with me.

If you are registered for the course, but do not receive the course email announcements to your University of Utah email address, please notify me immediately. It is not possible for me to arrange delivery of these emails to a non-Utah account, but you can forward your Utah emails to other email addresses. (Navigate to `http://www.cis.utah.edu`, login, and change your UMail settings.)

The section website will be used to communicate more technical matter of the class (e.g. problem sets, lecture summaries, etc.).

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to change that may be necessitated by a revised semester calendar or other

circumstances. The above two methods, in addition to the coursewide website, are reliable means of getting information about changes to the course.

Communication with the instructor: The most reliable and preferred means of contacting me is via email. Communication through Canvas will also work. One-on-one meetings can also be set up with me outside of office hours; please set up such meetings with me via email.

COVID-19 considerations: Students must self-report if they test positive for COVID-19 via `coronavirus.utah.edu`. All class activities will take place virtually via Zoom or similar software.

Student responsibilities and integrity: All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, and I will do so, beginning with verbal warnings and progressing to dismissal from and class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.
`http://regulations.utah.edu/academics/6-400.php`

Inclusivity: It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Discrimination and Harassment: If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or Office of the Dean of Students, 270 Union Building, 801-581-7066. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS). Please see Student Bill of Rights, section E `http://regulations.utah.edu/academics/6-400.php`. I will listen and believe you if someone is threatening you.

Names/Pronouns: Canvas allows students to change the name that is displayed AND allows them to add their pronouns to their Canvas name. Class rosters are provided to the instructor with the student's legal name as well as "Preferred first name" (if previously entered by you in the Student Profile section of your CIS account, which managed can be managed at any time). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class or on assignments. Please advise me of any name or pronoun changes so I can help create a learning environment in which you, your name, and your pronoun are respected. If you need any assistance or support, please reach out to the LGBT Resource Center: `https://lgbt.utah.edu/campus/faculty_resources.php`

English Language Learners: If you are an English language learner, please be aware of several resources on campus that will support you with your language and writing development. These resources include: the Writing Center (`http://writingcenter.utah.edu/`); the Writing

Program (http://writing-program.utah.edu/); the English Language Institute (http://continue.utah.edu/eli/). Please let me know if there is any additional support you would like to discuss for this class.

Undocumented Student Support: Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801-213-3697 or visit dream.utah.edu.

Veterans: If you are a student veteran, the University of Utah has a Veterans Support Center located in Room 161 in the Olpin Union Building. Hours: M-F 8-5pm.Please visit their website for more information about what support they offer, a list of ongoing events and links to outside resources: http://veteranscenter.utah.edu/.

Student wellness: Personal concerns such as stress, anxiety, relationship difficulties,depression, cross-cultural differences, etc., can interfere with a student's ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at www.wellness.utah.edu or 801-581-7776.

Student Success Advocates: The mission of Student Success Advocates is to support students in making the most of their University of Utah experience (ssa.utah.edu). They can assist with mentoring, resources, etc. Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact a Student Success Advocate for support (https://asuu.utah.edu/displaced-students).

The Americans with Disabilities Act: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 801-581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.

Addressing Sexual Misconduct: Title IX makes it clear that violence and harassment based on sex and gender (which Includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students,270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677 (COPS).

Safety: The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training

resources, including helpful videos, visit `safeu.utah.edu`.

University Counseling Center The University Counseling Center (UCC) provides developmental, preventive, and therapeutic services and programs that promote the intellectual, emotional, cultural, and social development of University of Utah students. They advocate a philosophy of acceptance, compassion, and support for those they serve, as well as for each other. They aspire to respect cultural, individual and role differences as they continually work toward creating a safe and affirming climate for individuals of all ages, cultures, ethnicities, genders, gender identities, languages, mental and physical abilities, national origins, races, religions, sexual orientations, sizes and socioeconomic statuses.

Office of the Dean of Students: The Office of the Dean of Students is dedicated to being a resource to students through support, advocacy, involvement, and accountability. It serves as a support for students facing challenges to their success as students, and assists with the interpretation of University policy and regulations. Please consider reaching out to the Office of Dean of Students for any questions, issues and concerns. 200 South Central Campus Dr., Suite 270. Monday-Friday 8 am-5 pm.

Semester calendar

(Subject to change!)

Day	Date	Text Section(s)	Topic
Tuesday	January 19, 2021		Hello
Thursday	January 21, 2021	1.1	Partial differential equations
Tuesday	January 26, 2021	1.2	The heat equation, flux, and conservation
Thursday	January 28, 2021	1.3 – 1.5	Boundary conditions and physical interpretations
Tuesday	February 2, 2021	2.1	Linear equation solutions and the heat equation
Thursday	February 4, 2021	2.2	Linear equation solutions and the heat equation
Tuesday	February 9, 2021	2.3	Separation of variables
Thursday	February 11, 2021	2.3	Separation of variables
Tuesday	February 16, 2021	2.3	Separation of variables
Thursday	February 18, 2021	2.4	Insulated boundaries, superposition
Tuesday	February 23, 2021	—	Review
Thursday	February 25, 2021	—	**MIDTERM EXAM 1**
Tuesday	March 2, 2021	2.5	Laplace's equation
Thursday	March 4, 2021	3.1	Fourier Series
Tuesday	March 9, 2021	—	Reading week (no class)
Thursday	March 11, 2021	—	Reading week (no class)
Tuesday	March 16, 2021	3.2	Fourier Series
Thursday	March 18, 2021	3.3	Fourier sine and cosine series
Tuesday	March 23, 2021	4.1 – 4.2	The wave equation
Thursday	March 25, 2021	4.1 – 4.2	Solving the wave equation
Tuesday	March 30, 2021	—	Review
Thursday	April 1, 2021	—	**MIDTERM EXAM 2**
Tuesday	April 6, 2021	10.1 – 10.2	Continuous Fourier transforms
Thursday	April 8, 2021	10.1 – 10.2	Continuous Fourier transforms
Tuesday	April 13, 2021	10.3	Fourier transform properties
Thursday	April 15, 2021	10.3	Fourier transform properties
Tuesday	April 20, 2021	10.4	The heat kernel
Thursday	April 22, 2021	10.4	D'Alembert's solution
Tuesday	April 27, 2021	—	Review
Wednesday	May 5, 2021	8:00am-10:00am	**FINAL EXAM**