Partial Differential Equations (MATH-325-01E)

CLASS SYLLABUS: Fall 2024

INSTRUCTOR INFORMATION

Instructor: Dr. Aditi Ghosh, Assistant Professor of Mathematics

Office Location: HENDERSON 303,

Office Hours(face to face, zoom (only in case you cannot be present in my office)): T,Th: 10.45am - 12:30 pm, 2pm -3:30 pm and and by appointment.

Class: T, TR 9:30 am 10:45 am in Binnion 330

Office Phone-903-886-5508

Office Fax: 903-886-5945

Email Address: Aditi.Ghosh@tamuc.edu

Preferred Form of Communication: email

Communication Response Time: usually within 24 hours during weekdays, M-F. Weekends may be over 48 hrs.

COURSE INFORMATION

This is a face-to-face class conducted on D2L Brightspace. Use the link https://leo.tamuc.edu, then, click the icon, D2L Brightspace for the class website. Please visit the class website to be familiar with it.

Course Materials:

This course will be taught using multiple formats: books, lecture, downloadable lecture notes, problem sets, examinations, and student projects.

Main Text Book: Applied Partial Differential Equations, Fourth/Fifth Edition (2003) by R. Haberman, Prentice-Hall,

Additional book for reference

Partial Differential Equations: An Introduction (2011) by Walter A. Strauss, John Wiley & Sons, Inc..

Introduction to Partial Differential Equations (2014) by Peter Olver, Springer, New York

We might use R /Python to solve a differential equation. **TI-89 will not be allowed in Exams, Bluetooths, cell phones are not to be uses during class and exams..**

Course Learning Goals :

Student will gain a clear intuitive understanding of the concept of partial differential equation and its relevance to describing physical phenomena such as diffusion and wave propagation.

Students will gain deeper understanding of the Fourier series by mastering the theory of boundary value problems.

Students will learn the separation of variables method to solve linear parabolic, elliptic and hyperbolic partial differential equations

Students will gain practical knowledge of the numerical techniques for solving partial differential equations using the finite difference method.

Students will learn the basics of the spectral Fourier transform method for solving PDEs on an infinite or semi-infinite domain.

Prerequisites: MATH 2415 Calculus III (Required)

                        MATH 2320 Differential Equations (Recommended)

Student Learning Outcomes: Upon successful completion of this course, students will be able to:

Students can derive the heat equation from basic principles such as energy conservation and the Fourier law of heat conduction

Students can calculate and visualize Fourier cosine or sine series of a function of one variable.

Students can prove orthogonality and uniqueness of solutions to a boundary value problem.

Students can use the Rayleigh Quotient to gain information about the lowest eigenvalue and the corresponding eigenfunctions for a boundary value problem

Students can write down the complete solution of a linear homogeneous wave, heat or Laplace's equation on a rectangular or rotationally-symmetric domain using separation of variables.

Students can apply the concept of linearity to solve non-homogenous PDEs by the method of linear superposition.

Students can solve the heat equation with Dirichlet boundary conditions using finite difference approach will develop an understanding of computational algorithms that are used to approximate numerical solutions of mathematical problems.

Students can use the Fourier transform method to solve the heat equation and the Laplace's equation in a semi-infinite plane or strip.

COURSE REQUIREMENTS

Evaluation is based on homework, quizzes, class participation, tests.

Attendance: Attendance is a vital part of the learning process and as a result, there will be a penalty for missed classes. Attendance is mandatory and class attendance will be taken at each class session.

(a) Excuses will be accepted only for major problems; students are expected to use their allowed absences wisely to cover special activities, family emergency, and minor illnesses.

(b) When an excused absence is requested the absence must be documented and beyond the student's control.

(c) Your reason for missing class should be legitimate supported by proper documentation.

(d) Please speak to the professor if you have special circumstances aecting your attendance.

2. Excessive absences may result in being dropped from the course.

(a) Students who are absent more than **8 times,** for whatever reason, are subject to the instructor dropping them from the course.

(b) Six absences in this course constitutes missing **1/4** of the course, which is a very large fraction of material for a student to miss.

(c) Any student who is close to this number of absences should come to the instructor before they accumulate four absences in the course.

Homework: Without doing homework, one cannot learn. Thus, homework must be done and submitted to show your study and attendance. Homework assignments will be given most of the weeks. Missing questions and answers without work do not earn credit.

Homework/Quizes will be through D2L or in person submission.

 Late homework will not be collected. The point value of each will be based on its complexity and scope. We will also have short in class presentations from students on topics (like matlab presentation, class lectures, R presentation, project discussion) given by the instructor every 10-15 mins of class. This will help exchange of ideas, invite more queries and discussions. Bonus grade will be determined from them. All students should complete and hand in their homework and take active part in class presentations, because this is the only way to develop an understanding of the concepts we will be studying in this class. On the other hand, feel free to interact with other students to exchange ideas, to learn tricks, and to get instructions about how to do each assignment. You may work and discuss homework together on D2L. To do so, click Activities, Discussions for each week on D2L. When you share your homework in Discussion on D2L, everyone can see it and download it. You still need to submit your homework in D2L. Feel free to ask your instructor questions in class or in office hours. The assignment you submit must be your own work. Plagiarism is prohibited.   Students are expected to provide 6-8 hours each week on the course outside the class.

There will be two exams in the form of written exams. One midterm and the other final exam, each worth 100 points. These will be discussed in details in class.

Exam 1: 9:30 AM – 10:45 PM, October /last week (date tentative to be discussed in class)

Project: 9:30 AM – 10:45 PM, November /mid week (date tentative to be discussed in class)

Final Exam: Comprehensive two hours, 8 AM – 10 PM, Dec 12th.

Grading: The maximum possible points available in this course are:

Homework/Quiz /Activity 100 points

Tests 200 points

Project 100 points

Total 400 points

Your course grade will be based on the percentage of the points you make to the total points available in the course:

A >= 90%, B >= 80%, C >= 70% D >= 60% F < 60%.

TECHNOLOGY REQUIREMENTS

TI-83/84 or other calculators with similar capability is highly recommended.

Scanner/digital camera/cell phone that you can make PDF files of your work and submit them to D2L. Make one PDF file for each test, project, glossary for each chapter, and homework for each chapter. Please visit the following video clips for making one PDF file:

o Using CamScanner: https://www.youtube.com/watch?v=sZFcQJCmtMI

o Android: https://www.youtube.com/watch?v=FWlVYd2Zc-E

o iPhone: https://www.youtube.com/watch?v=10XH6VfGLqI

D2L/LMS: All course sections offered by Texas A&M University-Commerce have a corresponding course shell in the myLeo Online Learning Management System (LMS). You will obtain the course materials through LMS. You cannot distribute the course materials without permission of the instructor. To access LMS, go to myLeo, then Apps, then My Leo Online D2L Brightspace. You also have an email account via myLeo - all my emails sent from D2L (and all other university emails) will go to this account, so please be sure to check it regularly.

Below are technical requirements

LMS Requirements: https://community.brightspace.com/s/article/Brightspace-Platform-Requirements

LMS Browser Support:

https://documentation.brightspace.com/EN/brightspace/requirements/all/browser_support.htm

YouSeeU Virtual Classroom Requirements: https://support.youseeu.com/hc/en-us/articles/115007031107-

Basic-System-Requirements

ACCESS AND NAVIGATION

You need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or helpdesk@tamuc.edu.

Course readings, assignments and discussions will be completed /turned in through LMS. Your grades will be available in LMS. The course materials are only for this course. You cannot distribute the course materials without permission of the instructor

This course is presented using weekly units. Each unit contains video lectures, a discussion area, assignments, a quiz or an exam. You should begin by reading the course syllabus, paying particular attention to the assignments and Suggested Day-by-Day Schedule, and then complete the Start Here unit.

Note: Computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include

the availability of a backup PC at home or work, the temporary use of a computer at a friend's home, the local library, office service companies, Starbucks, a TAMUC campus open computer lab, etc.

AI use in course

Texas A&M University-Commerce acknowledges that there are legitimate uses of Artificial Intelligence, ChatBots, or other software that has the capacity to generate text, or suggest replacements for text beyond individual words, as determined by the instructor of the course.

Any use of such software must be documented. Any undocumented use of such software constitutes an instance of academic dishonesty (plagiarism).

Individual instructors may disallow entirely the use of such software for individual assignments or for the entire course. Students should be aware of such requirements and follow their instructors' guidelines. If no instructions are provided the student should assume that the use of such software is disallowed.

In any case, students are fully responsible for the content of any assignment they submit, regardless of whether they used an AI, in any way. This specifically includes cases in which the AI plagiarized another text or misrepresented sources.

13.99.99.R0.03 Undergraduate Academic Dishonesty
13.99.99.R0.10 Graduate Student Academic Dishonesty

COMMUNICATION AND SUPPORT

Interaction with Instructor: You may email and telephone your instructor and visit your instructor at LMS. I will try to respond to your email within 24 hours, Monday through Thursday. My response over the weekend may be delayed.

The following features are available through Activities, Discussions:
Student Lounge: This space is for students to communicate with each other. I
may visit the Student Lounge and join your discussion. Weekly Discussion: This space is for student questions related to the week's content. Please feel free to answer one another's questions. I will check answers (as well as questions) for

correctness, but do not hesitate to respond to a posting if you feel you can answer the question thoroughly and directly. Math Lab: Free tutoring service offered by the Mathematics department (Binnion Hall Room 328). Please visit the web site for the hours of operation and more details.

http://www.tamuc.edu/academics/colleges/scienceEngineeringAgriculture/departments/mathematics/students/defa

ult.aspx

The TAMUC One Stop Shop- provides as many student resources as possible in one location.

http://www.tamuc.edu/admissions/oneStopShop/

The TAMUC Academic Success Center provides academic resources to help you achieve academic success.

http://www.tamuc.edu/CampusLife/CampusServices/AcademicSuccessCenter/default.aspx

Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support

at 1-877-325-7778. Other support options can be found here:

https://community.brightspace.com/support/s/contactsupport

Syllabus Change Policy

The syllabus is a guide. Circumstances and events, such as student progress, may make it necessary for the instructor to modify the syllabus during the semester. Any changes made to the syllabus will be announced in advance.

University Specific Procedures

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail in the Student Guidebook.

http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/

[**studentGuidebook.aspx**](studentGuidebook.aspx)

Students should also consult the Rules of Netiquette for more information regarding how to interact with students in an online forum: https://www.britannica.com/topic/netiquette

TAMUC Attendance

For more information about the attendance policy please visit the Attendance webpage and Procedure 13.99.99.R0.01. http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatemen/rulesProcedures/13students/academic/13.99.99.R0.01.pdf

Academic Integrity

Students at Texas A&M University-Commerce are expected to maintain high standards of integrity and honesty in all of their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/undergraduates/13.99.99.R0.03UndergraduateAcademicDishonesty.pdf

Graduate Student Academic Dishonesty 13.99.99.R0.10

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/graduate/
13.99.99.R0.10GraduateStudentAcademicDishonesty.pdf

Students with Disabilities-- ADA Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services

Gee Library- Room 162

Phone (903) 886-5150 or (903) 886-5835

Fax (903) 468-8148

Email: studentdisabilityservices@tamuc.edu

Website: Office of Student Disability Resources and Services

http://www.tamuc.edu/campusLife/campusServices/
studentDisabilityResourcesAndServices/

Nondiscrimination Notice

Texas A&M University-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

Campus Concealed Carry **Statement**

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in Texas A&M University-Commerce buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and A&M-Commerce Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations.

For a list of locations, please refer to the Carrying Concealed Handguns On Campus document and/or consult your event organizer. Web url:

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/
34SafetyOfEmployeesAndStudents/34.06.02.R1.pdf

Pursuant to PC 46.035, the open carrying of handguns is prohibited on all A&M-Commerce campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.

Tentative Schedule

- Weeks 1-2 Introduction: PDEs in physics; derivation of 1D heat equation, Heat equation: Equilibrium solutions; boundary & initial conditions,Heat equation in higher dimensions,Linearity & superposition

- Weeks 3-4 Linearity & superpositions, Fourier series ,Solving heat equation in 1D rod: insulated ends

- Weeks 5-6 Solving heat equation in 1D rod: circular ring,Laplace's equation inside a rectangle,Laplace's equation inside a disk; qualitative properties

- Weeks 7-8 Wave equation: 1D derivation and vibrating string with fixed ends, Wave equation: boundary conditions and vibrating string continued, **Exam I (Written Exam**)

- Weeks 9-10 Laplace Transform, Sturm-Liouville eigenvalue problems: properties; proof of orthogonality, (Class project)

- Week 11-12 Sturm-Liouville problems: self-adjointness; Rayleigh quotient,Rayleigh Quotient test function examples

- Weeks 13-14 More Rayleigh Quotient examples; Robin boundary conditions., Review, Project preparation **Final Exam**

COPYRIGHT: The course materials are only for use in this course. You cannot distribute the course materials without permission of the instructor.

A&M-Commerce Supports Students' Mental Health

The Counseling Center at A&M-Commerce, located in the Halladay Building, Room 203, offers counseling services, educational programming, and connection to community resources for students. Students have 24/7 access to the Counseling Center's crisis assessment services by calling 903-886-5145. For more information regarding Counseling Center events and confidential services, please visit www.tamuc.edu/counsel

Regarding the University's Pandemic Response

COVID-19 Statements from the University

The COVID-19 situation is constantly evolving and is subject to change based on the recommendations and requirements given by the CDC, state and local leaders, and the Texas A&M University System.

1)   Students, faculty, and staff are strongly encouraged to get vaccinated, wear a mask in public indoor settings, and wash hands frequently. These actions can reduce the spread of COVID-19.

2)   The following requirements will be in place this fall:

a.   Students, faculty and staff must participate in the mandatory COVID-19 testing program at intervals designated by the university.

b.   Students, faculty and staff who test positive or have been identified as a close contact may be required to quarantine/isolate consistent with current CDC guidance as shown here.

c.   Students, faculty and staff who test positive for COVID-19 are required to isolate. Those with COVID-19 symptoms or who have had close contact with someone (within 6 feet of someone for a cumulative total of 15 minutes or more over a 24- hour period) who received a positive test result for COVID-19 are required to email the A&M-Commerce Emergency Operations Center at eoc@tamuc.edu for additional guidance on how to proceed.

d.   Students new to the university must confirm they've read and agree to adhere to the following guidelines. Please click the following link to complete the acknowledgment: COVID-19 Acknowledgment.

3)   Students who do not comply with mandatory COVID-19 reporting, testing and/or quarantine/isolation requirements will go through the Student Conduct Process. This may result in a student facing possible separation (i.e., suspension or expulsion) from the University or being considered a student "not in good standing."

4)   Please go to the University home page for reading the entire Fall 2021 COVID-19 Management and Guidance Plans for details, and scheduling a COVID test.