33-759

Course Information:

Lectures: Mon & Wen & Fri 1.20-2.10pm CMU Remote (via zoom)

Recitation Wen 5.20-6.10pm CMU Remote (via zoom)

Instructor: Tina Kahniashvili,

Department of Physics, Wean Hall 8020, 5000 Forbes Ave, Pittsburgh, PA 15206

E-mail: tinatin@andrew.cmu.edu

Tel: (412) 268-1818

Office Hours:

By appointment

Zoom Meetings:

https://cmu.zoom.us/j/4122681818

Meeting ID: 412 268 1818

Course Description:

Overview

This course is an introduction to methods of mathematical analysis used in solving physical problems. Emphases is placed both upon the generality of the methods, through a variety of sample problems and upon their underlying principles. Topics normally covered include matrix algebra (normal modes, diagonilazation, symmetry properties), complex variables and analytic functions, differential equations (Laplace's equation and separation of variables, Green functions, special functions and their analytic properties), orthogonal systems of functions, integral transforms and integral equations.

Course Goals

The main goals of the course consists:

To become familiar with mathematical methods for application to physics problem

To develop student's facility with specific mathematical techniques

To learn how use complex analysis while solving physical problems

To give mathematical tools to better understand physical concepts

Course Content (subject to change)

Vector spaces (including Hilbert spaces)

Eigenvalue problems

Ordinary differential equations

Sturm-Louville Theory

Partial differential equations

Green's functions

Complex variables theory

Further topics in analysis (orthogonal polinomials, infinite products, dispertion relation, etc)

Special functions (Gamma function, Bessel functions, Legendre functions, spherical harmonics)

Integral transforms and integral equations

Calculus of variations

Course website:

http://www.cmu.edu/canvas; course materials will be posted at Piazza as well.

Recorded lectures will be posted at Canvas.

Course Textbooks:

Main Textbook:

Mathematical Methods for Physicists (Arfken, Weber, Harris, 7th edition, Academic Press)

Additional Textbooks:

Mathematics for Physics: A Guide Textbook For Graduate Students (Stone & Golbart, PIMANDER-CASAUBON)

Given that some students will be attending classes from locations around the world, they may face difficulty acquiring their traditional, commercial print textbooks. Additionally, some students may face emergency costs and financial pressures that impact their ability to pay for needed course materials and supplies. At this point please let me know if you need assistance in obtaining access to online materials such as textbooks, or please contact CMU libraries.

Assignments and Exams:

You will be assigned a variety of assignments, such as homework, classwork/recitation, presentations, etc. Homework will be assigned bi-weekly being due in two weeks. The late homework will be accepted under some circumstances with a prior discussions prior the due date. There will be midterm and final exams. I strongly encourage you to work on assignments with your classmates, however your final work (such as homework) must be completed by your own, referring for all resources that were used, see Academic Integrity below.

Grades:

Grading will be based:

Homework 30%

Midterm 20%

Participation 10%

Final Exam 40%

Each homework max grade will be 100 points with an optional bonus problem (20 points). If the homework will be submitted using latex editor (pdf format) – additional 5 points (5% of max) will apply.

Policies:

Attendance: Students are expected to attend the lectures and recitation and participate intensively in the classwork. Each class will involve a mix of lecture, discussion, and possibly one or more student activities. Participation credit will be awarded for these activities. I encourage you to schedule office hour meetings in order to discuss the course related questions: material covered in class and in the textbooks.

Academic integrity: Academic integrity is regulated by Carnegie Mellon University Policies https://www.cmu.edu/policies/student-and-student-life/academic-integrity.html.

In particular, below I present the quote:

Academic credit awarded to an individual should represent the work of that individual. Therefore, students at Carnegie Mellon are expected to produce their own original academic work. Collaboration or assistance on academic work to be graded is not permitted unless explicitly authorized by the course instructor(s). The citation of all sources is required. When collaboration or assistance is permitted by the course instructor(s), the acknowledgement of any collaboration or source of assistance is likewise required. Failure to do so is dishonest and is the basis for a charge of cheating, plagiarism, or unauthorized assistance. Such charges are subject to disciplinary action. For disciplinary action procedures that apply to charges of cheating, plagiarism, or unauthorized assistance, see https://www.cmu.edu/student-affairs/theword/academic-discipline/index.html

Any specific questions must be directed to Office of the Vice President for Student Affairs. Questions on Policy content should be directed to the Office of Community Standards and Integrity, 412-268-2140.

Zoom Using during Classes: In our class, we will be using Zoom for synchronous (same time) sessions. Please make sure that your Internet connection and equipment are set up to use Zoom and able to share audio and video during class meetings. (See https://www.cmu.edu/computing/start/students.html from Computing Resources for information on the technology you are likely to need.) Let me know if there is a gap in your technology set-up as soon as possible, and we can see about finding solutions.

Sharing video: In this course, being able to see one another helps to facilitate a better learning environment and promote more engaging discussions. Therefore, our default will be to expect students to have their cameras on during lectures and discussions. However, I also completely understand there may be reasons students would not want to have their cameras on. If you have any concerns about sharing your video, please email me as soon as possible [insert email] and we can discuss possible adjustments. Note: You may use a background image in your video if you wish; just check in advance that this works with your device(s) and internet bandwidth.

Video recording: All synchronous classes will be recorded via Zoom so that students in this course (and only students in this course) can watch or re-watch past class sessions. I will make the recordings available on Canvas as soon as possible after class session (usually within 3 hours of the class meeting).

Please note that you are not allowed to share these recordings. This is to protect your FERPA rights and those of your fellow students.

Student Support

Disability resources: If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at https://www.cmu.edu/disability-resources/policies-guidelines/index.html for additional resources and accommodations.

Student Well-Being This semester is unlike any other. We are all under a lot of stress and uncertainty at this time. Attending Zoom classes all day can take its toll on our mental health. Make sure to move regularly, eat well, and reach out to your support system or me if you need to. We can all benefit from support in times of stress, and this semester is no exception.

Counseling and Psychological Services: Take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is almost always helpful.If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, I strongly encourage you to seek support.There are resources available to help you when needed. Several studies show that the most successful students are ones who identify and utilize their support resources early and often. Please note that all services are confidential, you are not only one and alone! 15% of the current CMU students decided to seek help during their struggles, finally asking for help is a sign of psychological strength not a weakness. If you experience hard times, please do not hesitate to reach Counseling and Psychological Services (CaPS) : 412-268-2922 and visit the website:

https://www.cmu.edu/counseling/.

Additional Resources are available: Resolve Crisis Network: 888-796-8226.

If the situation is life threatening, call the police:

On campus: CMU Police: 412-268-2323 Off campus: 911