University of Florida

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MAP 6506: Mathematical Methods in Physics II (online)

Prerequisites

UF Calculus 3, Linear Algebra, and Introduction to Partial Differential Equations are necessary. UF Advanced Calculus or Mathematical Analysis or their equivalents and Part I of this course are very helpful, but not mandatory. However, basic concepts of the theory of distributions and the Lebesgue integration theory have to be reviewed in order to understand the beginning of Part II (Green's functions for differential operators). The main part of Part II, the theory of operators in Banach and Hilbert spaces, is not based on Part I.

Recommended Texts

V.S. Vladimirov, Equations of Mathematical Physics
F. Riesz and B. Sz.-Nagy, Functional Analysis
I. Stakgold, Green's functions and boundary value problems,
M. Reed and B. Simon, Methods of Modern Mathematical Physics, Vol 1-4 (for advanced reading).

There will be lecture notes that are close to the actual classroom lectures. They will be posted in the course page.

Course Content

The detailed course content is posted in the course webpage along with references to the corresponding topics in the aforementioned textbooks. In brief, the course covers Green's functions for basic differential operators, integral equations, Hilbert and Banach spaces, basic concepts of the theory of operators in Hilbert spaces, in particular, the theory of self-adjoint operators in Hilbert spaces (as a foundation for the Fourier method in PDEs and the spectral theorem for quantum physics), compact operators, the resolvent of an operator, Fredholm alternative for linear operators on a functional space, bounded and unbounded operators. Some applications to integral equations, boundary value problems for basic PDEs in mathematical physics and engineering, and wave scattering theory. It is also possible to include elements of the Lie group theory and solitons in PDEs (if time permits and all students are interested in such a topic).

Remark: Students who did not take Part 1 of the course are advised to review some basic topics on distributions using Chapter II (Sections 5-8) of the textbook by Vladimirov. They can also view recorded lectures of Part I (the links can be found in the course page).

Online and F2F classes

The course has face-to-face (F2F) and online sections. The attendance for the F2F section is mandatory for everyone who registered for this section. You must be cleared to attend F2F classes. Anyone who does not have clearance will not be admitted to the class meetings. You can switch to the online section only during the first week of classes (the official add and drop period). The F2F section will meet 2 times per week. The students in the online section should attend these meetings at the same time but online. All students are responsible for taking notes (if recording is not available or not working in the room where the class meets). The third meeting is via Zoom. The schedule for all Zoom meetings will be set via Canvas. If at the end of the first week the F2F section is empty, the course will go online and become an asynchronous course (as Part I). In this case, all lectures will be prerecorded and posted in the course page, and they can be viewed anytime and multiple times (even when doing graded assignments). There will be 3 prerecorded lectures per week to view and two non-mandatory Zoom sessions to discuss the lectures and clarify any questions as well as to do some of the homework (practice) problems. The first class meeting will be via Zoom for all sections. The link to the meeting will be posted in Canvas.

Exams

There will be 10-12 graded assignments and the final exam. The graded assignments will be conducted via Canvas every week or every other week. Each assignment covers the material given in 3-6 lectures prior the assignment. Each assignment is open for a specified period of time (e.g., a weekend) during which it must be completed and submitted via Canvas. The submission is free-response. Indicate the problem number, write your solution (do not omit technical details), box the answer, do the same for all problems, enumerate all pages as 1/n, 2/n, …, n/n, where n is the total number of pages, write and sign the academic honesty pledge at the bottom of the last page, write your name and your UFID number, scan all the pages in the above order into a single PDF file, and submit the file via Canvas. Make sure that you have a software or app to make such a PDF file. Other formats are not acceptable. Late submissions will not be accepted. The final exam is cumulative and will be conducted in the same fashion as regular graded assignments. You may use anything to prepare your submissions.

Special accommodation: Students requesting special accommodation for exams must first register with the Dean of Student Office. The Dean of Student Office will provide documentation to the student who must then provide this documentation to me when requesting accommodation.

Student honor code: Each submitted assignment must contain the signed academic honesty pledge: “Herewith I acknowledge that I did all the above problems myself and did not receive any help from any person”. Submissions without the signed honesty

pledge will not be accepted. You are NOT allowed to discuss any assignment during the time period the assignment is open on Canvas. A breach of this policy is considered as cheating. If caught cheating, the course grade is an F, no exception.

Homework

Lecture notes contain practice problems. Solving these problems is essential for understanding the course and attaining a good grade. Some of the homework problems can be discussed during the zoom meetings.

Grading

Each assignment contains some number of problems. Each problem is worth one point if solved correctly. If M is the total number of earned points and N is the total number of regular problems given, then your current grade is the average:

G = (M/N) 100%

The grade thresholds are:

A: G>90; A-: G>85; B+: G>80; B: G>75; B-: G>70; C+: G>65; C: G>60; C-: G>55; D+: G>50; D: G>45; D-: G>40; F: G<40

Extra credit: There will be extra credit problems given in some of the assignments. They are not counted in the number N, but can increase your number M if solved correctly. The perfect score can therefore exceed 100% when the extra credit questions are correctly answered. Do not count much on these problems to increase your score later in the semester. These problems are more difficult than the regular ones.