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MAP 6505: Mathematical Physics I, Syllabus

Prerequisites

UF Calculus 3, Linear algebra, and Differential equations (necessary), Introduction to Partial Differential Equations (recommended), UF Advanced Calculus or Mathematical Analysis or their equivalents (helpful, but not mandatory). No permission for graduate students is required to enroll. Graduate students decide for themselves how well they know prerequisites. Undergraduate students willing to take this course have to get a permission from the department (please email me on this matter indicating UF mathematics courses you have taken).

Recommended Texts

L. Schwartz, Mathematics for Physical Sciences,
V.S. Vladimirov, Equations of Mathematical Physics,

Lecture Notes

There are typed lecture notes for most of the course. They will be posted in the course page.

Course Content

Review of the Riemann integration theory in Euclidean spaces. Absolutely and conditionally convergent improper integrals. The Lebesgue theory of integration. Functions defined by Lebesgue integrals. Potential type integrals and Gaussian integrals. The theory of distributions (the main part of the course). This includes Dirac delta-functions and other singular distributions, regular and tempered distributions, differentiation and integration of distributions, direct product and convolution of distributions, convolution algebra, and Fourier transform of tempered distributions. Basics equations of mathematical physics. Distributional solutions to linear partial differential equations. Fundamental solutions for linear differential operators (Laplace, Helmholtz, wave, heat, and Schroedinger operators in various dimensions). Causal Green's functions and the Cauchy (initial value) problem for basic equations of mathematical physics (heat, wave, and Schroedinger equations). Wave potentials and wave propagation in various dimensions. Green's function for a Helmholtz operator satisfying Sommerfeld radiation conditions and applications to wave scattering (time permitted). The emphasis will be put on applications of the discussed mathematical

concepts. However, all the concepts and statements will be rigorously treated. If a proof is not given in class, a reference to a text where it can be found will be provided.

Lectures

There will be three lectures per week. A brief description of each lecture will be posted in **the course page** along with recommended texts useful for further reading on the topic discussed. Due to the pandemic, the lectures were recorded in the past for the online version of the course. They will be available to watch through the links in the Canvas shell of the course. Note that questions during the in-person lectures are strongly encouraged. So, the recorded lectures can differ from the actual ones because the content is adjusted each semester depending on the class and interests of the students. Not to mention, active classroom discussions make a far more effective format for reaching crystal clarity of the course concepts than watching a "soap opera" on mathematical physics with just one actor.

Written assignments and Homework

Homework: Lecture Notes and recommended textbooks contain exercise problems almost for every lecture. They are not mandatory but doing them would be of great help to do well on written assignments. Homework problems will be assigned during the lectures and some of them will be included into graded assignment.

Graded assignments: Every 2-3 weeks there will be a graded homework assignment. It will be open via the Canvas shell of the course. Each assignment is not cumulative and covers only the material discussed after the previous assignment. It should be completed in a few days and submitted by the posted due time. The submission should be prepared as follows. Pick any problem from the assignment, mark its number, write your solution with ALL technical details clearly indicating how the final answer is obtained. Box the final answer. For example, if you use a particular theorem in your solution, make sure that the hypotheses of this theorem are shown to hold (otherwise no credit). Do the same for as many problems as you know how to solve. Enumerate all pages as 1/n, 2/n, …, n/n where n is the total number of pages in your submission. In the bottom of the last page write and sign the academic honesty pledge (the text will be provided with the exam). Scan your work into a single PDF file and name the file as LastNameFirstNameHW# (where # is the assignment number, 1, 2, etc.). Here are some useful Apps for scanning: CamScanner, Adobe Scan, Scanbot, Microsoft Office Lens, Evernote Scannable, Google Drive, TapScanner, PhotoScan, TurboScan among others. Submission via Canvas is encouraged. Depending on the pandemic situation, there will be midterm and final exams conducted in-person. The dates will be decided after the classes start. You may use only your own notes during the in-person tests. Any use of any electronic devices or textbooks is prohibited (laptops, phone, calculators, e-watches, etc.). The midterm and final exams will be time-limited and conducted in the evening hours (6-9 pm) (online or in-person).

Grading

Each assignment contains some number of problems and each problem is worth a point if solved correctly. If N is the total number of assigned problems and M is the total number of points earned, then your current score is G=100(M/N) rounded to the

nearest integer. 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; E: G<40

Extra credit: Occasionally an extra credit problem will be added to an assignment. It does not increase N, but it would increase M if solved correctly.

Office Hours

You can ask questions about course topics and homework assignments after every lecture (6-7 pm). Otherwise make an appointment by email for either in-person or Zoom meeting.

Policies

Attendance: No credit for attendance of lectures.

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: When turning in any graded assignment, please write “I did the assignment myself and received no help from anybody” and sign it. Assignments turned in after the due date and/or without a signed academic honesty pledge will not be accepted.

Pandemic policies: Students are expected to comply with all UF policies for in-person classes during the pandemic. In particular, if you have symptoms, stay home, watch recorded video lectures, and return to the classroom when you have a negative test.