Physics 410 — Mathematical Physics — Fall 2023

Instructor: Pavel Kovtun, Elliott 110

Classes: Tuesday, Wednesday, Friday, 8:30 – 9:20, Clearihue A312

Office hours: drop by my office, or email to make an appointment

Content: This course is intended for physicists, not mathematicians. There will be no proofs, very little mathematical rigor, and lots of problems. The class will not be a smooth flow of sequential "A to Z" topics, but rather a collection of different mathematical methods and applications that are useful in Physics. This class will focus on complex variables, ordinary differential equations, and approximations. We will touch on linear algebra, vector calculus, special functions, and Fourier transforms. We will solve problems from the physics of waves, classical and quantum mechanics, and electromagnetism.

Books: There is no required textbook. *Mathematics for Physicists* by Susan Lea is a fairly pedagogical book with examples and problems. If you want just one bedtime book on mathematical methods in physics, that would be the one I recommend. Many examples in the class will come from Lea's book. *Mathematical Methods in the Physical Sciences* by Boas is an elementary reference if you want to refresh you memory about basic math. *Mathematics for Physicists* by Dennery and Krzywicki is shorter, more mathematical, and has fewer examples. *Advanced Mathematical Methods for Scientists and Engineers* by Bender and Orszag has an extensive discussion of differential equations and approximation methods that I will use in class.

Prerequisites: I will assume that you are familiar with the basic relevant math: complex numbers, linear algebra, differential equations, as well as with basic quantum mechanics and electromagnetism. Some of the homework assignments will ask you to do computer calculations, please familiarize yourself with one of the computer programs suitable for numerical calculations such as Mathematica, Maple, Matlab, Python etc.

Homework assignments: For the homework assignments, feel free to discuss the problems with your colleagues, but the final written solutions must be your own. The problems will be posted to Brightspace. Scan your handwritten solutions and upload the single multi-page pdf file to Brightspace. Late assignments will not be accepted.

How to present your solutions: A general rule for assignments and exams: you must explain what you are doing and show all your work, in a form that is legible and organized. Simply writing down the answer or presenting an unedited "stream of consciousness" will result in zero credit, regardless of whether your answer is correct or not. If you are writing computer code to solve a problem, your code must have human-readable plain-English comments which explain what each part of the code is doing. Code without human-readable comments will not be accepted as valid.

Course materials: My lecture notes, assignments, solutions, etc will be uploaded to Brightspace. Note that you may not distribute any course materials without the instructor's permission, and that to do so, through note-sharing sites or other means, violates UVic's Policy on Academic Integrity.

Evaluation: There will be regular homework assignments and a final exam. Homework assignments will count for 50% of the course grade, and the final exam will count for 50% of the course grade. *One has to pass the final exam to get a passing grade.* The university-mandated correspondence between letter grades and percentage points is as follows: A+: 90 or more; A: 85-89; A−: 80-84; B+: 77-79; B: 73-76; B−: 70-72; C+: 65-69; C: 60-64; D: 50-59; F: below 50.

Academic year important dates: The add/drop dates, holidays, reading breaks, etc are listed here: https://www.uvic.ca/calendar/dates/