Physics 410 — Mathematical Physics — Fall 2020

Instructor: Pavel Kovtun

Logistics: The course will be run remotely, via the videoconference system ZOOM. The lectures will be held live on ZOOM, on Tuesday and Friday, 14:30 – 15:50. You need to go to `uvic.zoom.us` to sign in and activate your ZOOM account before the term starts. The link to join the class is on the Brightspace page. If you have questions, please email me at `pkovtun@uvic.ca`.

Description: This course is intended for physicists, not mathematicians. There will be no proofs, very little mathematical rigor, and lots of problems related to waves, classical mechanics, quantum mechanics, and electromagnetism. 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. We will talk about complex variables, differential equations, Fourier series, Fourier transforms, and the delta function. We'll talk about boundary value problems and special functions. We'll talk about different coordinates, tensors, and the metric. Hopefully we'll have time to talk about groups, including continuous groups, and their connection to spin.

Books: There is a very large number of books on the relevant mathematical methods. This class has no required textbook; the following books will hopefully be useful. *Mathematics for Physicists* by Susan Lea is a fairly pedagogical undergraduate textbook with examples and problems, though out of print. *Mathematics for Physicists* by Dennery and Krzywicki is shorter, more mathematical, and has few examples. *Mathematical Methods in the Physical Sciences* by Boas is an elementary textbook reference. *Advanced Mathematical Methods for Scientists and Engineers* by Bender and Orszag has an extensive discussion of ODEs and approximation methods.

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

Assessment components: Class assessment includes homework assignments, in-class quizzes, and the final exam. There will be no mid-term exam. For the assignments, feel free to discuss the problems with others, but the final written solutions must be your own. There is no need to typeset your solutions: scan your handwritten solutions and upload the single pdf file to Brightspace. A general rule: 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.

Evaluation: Homework assignments will count for 30% of the course grade, in-class quizzes will count for 20% 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.