Syllabus/Course Outline

PHYS410 – Topics in Mathematical Physics – Fall 2026

Instructor: Dr. Jesse Mumford

Class Time: Monday/Thursday 8:30am – 9:50am Sep 09 – Dec 07	**Class Location:** Main Campus
Office Hours: Wednesday 12:30pm – 2:00pm You can schedule one-on-one office hours via email.	**Office Location:** Elliott Building | Room 215
Preferred Contact: Email (response within 1-2 workdays). **No Brightspace messages please.**	**Email:** jmumford@uvic.ca
Units: 1.5 **Credit Hours:** 3-0-0	**Pre- or corequisites:** Completed or concurrently enrolled in all of: PHYS321A, MATH211, MATH346 **Recommendations:** One of PHYS313, PHYS314, PHYS323, and PHYS326 prior to this course

Course Content & Philosophy: This course is aimed at physicists rather than mathematicians, and our emphasis will therefore be on developing a practical understanding of mathematical methods rather than on formal proofs. We will build this understanding primarily by working through examples and applying mathematical techniques to physical problems. In this sense, the course can be viewed as an extended tutorial designed to strengthen your knowledge of various mathematical tools.

The course will focus primarily on complex variables, ordinary differential equations, and approximation methods. We will also cover aspects of linear algebra, vector calculus, special functions, and Fourier transforms. Throughout the course, these mathematical tools will be applied to problems drawn from wave physics, classical and quantum mechanics, and electromagnetism.

Books: There is no required textbook for this course. The lecture notes I will be using will be posted on Brightspace sometime during the week before the material is covered in class. For students interested in supplementing the lecture notes, a comprehensive reference for the course is *Mathematical Methods for Physicists* by Arfken, Weber, and Harris. In the latter half of the course, when we discuss approximation methods for ordinary differential equations and asymptotic expansions, I will also draw material from *Advanced Mathematical Methods for Scientists and Engineers* by Bender and Orszag. This is an excellent reference for a wide range of approximation techniques important in differential equations and integrals.

Prerequisite Knowledge: Students are expected to have a basic understanding of mathematical concepts such as calculus, linear algebra, and complex numbers. Familiarity with core physics topics, including classical mechanics and electromagnetism, as well as some exposure to quantum mechanics, is also expected.

Some assignments will require computational work. Students should therefore develop familiarity with mathematical software such as Mathematica or MATLAB (available to students) or with a general-purpose programming language such as Python.

Homework Assignments: For the homework assignments, I encourage you to discuss the problems with your classmates. The final written solutions must however 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. Do not wait until the last minute to upload your solutions to Brightspace, as the submission window will close. Assignments submitted by email will not be accepted.

The lowest assignment grade will be dropped.

Assessment: There will be regular homework assignments, a midterm exam, and a final exam. <u>The midterm exam is on Monday, October 26th, in class</u>. Homework assignments will count for 25% of the course grade, the midterm exam will count for 25% of the course grade, and the final exam will count for 50% of the course grade. *One must pass the final exam to get a passing grade*.

Your class grades will be based on written descriptions in the University Calendar, Grading

How to present your work: For assignments and tests, it is important that you clearly show the steps used to arrive at your solution and provide explanations for your reasoning. Simply providing a final solution without sufficient supporting work will result in a substantial loss of marks. On the other hand, work that demonstrates clear reasoning may receive much fewer lost marks even if the final solution is incorrect. When grading assignments and tests, I am primarily interested in assessing your understanding of the material.

Any code used as part of a solution should also include clear, plain-English comments describing the purpose and main workings of each section of the code.

Course Materials: 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.

Attendance: Attendance is not mandatory; however, students who attend classes regularly generally perform better in the course. I also strongly encourage you to make use of office hours whenever you are stuck on a concept or problem. It is important to nip misunderstandings in the bud as they arise rather than scramble at the last minute before a test.

AI Policy: The use of AI is *not* prohibited in this course, but it should be used responsibly. I ***strongly*** recommend that you do not rely on AI to learn new material for the first time. Instead, AI is best used to supplement and expand your understanding once you have developed a foundation in the topic.

An important part of learning is the process of working through a problem yourself by attempting a solution, making mistakes, becoming frustrated, reconsidering your approach, and trying again. This process is essential for internalizing new concepts and developing problem-solving skills. AI tools can provide shortcuts that bypass much of this process, and overreliance on them can harm one's ability to think critically.

Academic Year Important Dates: The add/drop dates, holidays, reading breaks, etc are listed here: Academic important dates - University of Victoria

List of Student Resources: General Information