PHYS	612 Mathematical Physics II Spring 2022
Instructor:	Chung-Sang Ng
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Class meets:	MWF 10:30 AM - 11:30 AM, Reichardt 203
Office hours:	TBD; will be announced on Blackboard
Credits:	3 credits: 3 hours/week of lecture.
Textbook:	"Mathematical Methods for Physicists", 7th ed., by Arfken, Weber, and Harris
Prerequisites:	Graduate standing, Phys/Math 611
Course Home Page:	Blackboard

## I. Course Description

The UAF Catalog listing for PHYS 612: "Continuation of Mathematical Physics I; mathematical tools and theory for classical and modern physics. Core topics: classical solutions to the principal linear partial differential equations of electromagnetism, classical and quantum mechanics. Boundary value problems and Sturm-Liouville theory. Green's functions and eigenfunction expansions. Integral transforms. Orthogonal polynomials and special functions. Applications to problems arising in physics. Selected additional topics, which may include integral equations and Hilbert-Schmidt theory, perturbation methods and probability theory."

In terms of the content of the textbook (which you must have and bring to classes), we will try to cover most topics from Chapter 13 to 23 during the spring semester. We will not cover everything in these chapters, due to the fact that we only have limited amount of time, not because other topics are not important. At the end of this syllabus is a tentative schedule which lists topics we plan to cover in more details. This is subject to change. So you should check frequently the online version of this page on Blackboard.

## **II.** Course Goals

The main goal of this course is to introduce you to some fundamental advanced mathematical methods for physics at the beginning graduate level to help students learning better in other graduate physics courses and doing research in their graduate studies. Emphasis will be on application aspects of the subject rather than proofs of theorems.

## **III. Student Learning Outcomes**

- Know how to apply some advanced mathematical methods to solve physics problems.
- Be able to solve most PhD Mathematical Physics comprehensive exam questions in recent years.
- Can apply rigorous mathematical and logical manipulations in the study and research of physics.

## IV. Textbook

You must have a copy of the textbook: <u>"Mathematical Methods for Physicists"</u>, <u>7th ed., by Arfken, Weber</u>, <u>and Harris</u>. It is very important that you read the Section(s) covered within each lecture and try to follow derivations before you come to that lecture. Please refer to the schedule below (subject to change) for such reading assignments. You should bring your textbook to the lectures.

You will find it extremely useful to have some mathematical references, handbooks, or tables, e.g., table of integrals. There are many options available from the Internet, but you should be cautious about the accuracy of information obtained there. One recommendation is <u>Abramowitz and Stegun: Handbook of Mathematical Functions</u>, which can be downloaded freely. Another one is <u>Gradshteyn and Rhyzik</u>. A handy collection of useful formula is the <u>NRLPlasmaFormulary</u>, which you can order





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