

Physics 812 — Methods of Theoretical Physics II

Spring 2024

Meeting Time

Meeting time: 09:00 – 10:20 AM MW, Jorgensen Hall, Room 245

Makeup Lecture: 9:00 – 10:20 AM F, Jorgensen Hall, Room 245 (as needed)

Instructor

Brad Shadwick, 310N Jorgensen Hall, 472-3578, shadwick@unl.edu

Office Hours: Drop by or by appointment.

Text

There is no formal textbook for this course. Useful references include:

- Byron & Fuller, *Mathematics of Classical and Quantum Physics*, Dover 1992.
- Gradshteyn & Ryzhik, *Table of Integrals, Series, and Products*, Academic Press, 2015.
- Mathews & Walker, *Mathematical Methods of Physics*, Benjamin, 1970.
- Hassani, *Mathematical Physics*, 2nd. ed. Springer 2013.
- Nayfeh *Introduction to Perturbation Techniques*, Wiley, 1993.
- Stackgold, *Green's Functions and Boundary Value Problems*, Wiley 1979.
- Stackgold, *Boundary Value Problems of Mathematical Physics*, Macmillan 1968.
- Vladimirov, *Methods of the Theory of Generalized Functions*, Taylor & Francis 2002.
- Zwillinger, *Handbook of Differential Equations*, Academic Press 1997.

[Hassani](#), [Gradshteyn](#), and [Zwillinger](#) are available electronically; the others are on reserve in the Engineering Library.

Prerequisites

Elementary methods for differential equations, some linear algebra, complex variables and functional analysis.

Course Outline

- Generalized functions
- Green's functions
 - initial value problems
 - boundary value problems
- Integral transforms
 - solution of ODEs
 - solution of PDEs
- Wave equation
 - Method of characteristics
 - Shocks
 - Dispersion relations

Additional possible topics, time permitting:

- Integral representations

- Integral equations
- Conformal mapping
- Asymptotic methods

Homework

Mastering the concepts covered in this course requires solving problems. The importance of doing and fully understanding the homework problems cannot be over emphasized. Homework will be throughout the semester and will be due approximately one week later. While discussing homework problems with other students is encouraged, the work you turn must be yours alone. In your solutions, you **must state** all sources (people, web sites, books, *etc.*) from which you obtained part or all of a solution.

Exams

There will be one mid-term exam, tentatively scheduled for Thursday, March 21 from 7:00 to 9:00 PM. A comprehensive two hour final exam is officially scheduled for 7:30 AM on Thursday, May 16, 2024. *If you have a conflict with either exam time, it is your responsibility to notify the instructor immediately.*

Grading (approximate)

- 1/3 Final exam
- 1/3 Mid-term exam
- 1/3 Homework

Web Pages

Course materials will be available through the Canvas system.

Makeup Lecture Time

The instructor will likely need to miss a class from time to time. Makeup lectures will be scheduled as necessary and held **Fridays at 9:00–10:20AM**.

UNL Course Policies

Students are responsible for knowing the university policies found at <https://go.unl.edu/coursepolicies>.