

Physics 914: Electromagnetic Theory II (Spring 2023)

Mondays, Wednesdays, and Fridays, 12:30-13:20

Jorgensen Hall 245

Instructor: Evgeny Tsymbal

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Office Hours: by agreement. Appointments to be made by e-mail or in class after the lecture

Classes begin 23 January

Spring Semester Break 12 – 19 March

Last day of classes 12 May

Course outline

I. Maxwell's Equations and Conservation Laws

Summary of electromagnetism: electrostatics, magnetostatics, Faraday's law, displacement current, boundary conditions; *Conservation laws:* Conservation of energy, Poynting vector, Maxwell's stress tensor, conservation of momentum, angular momentum

II. Electromagnetic Waves

Waves in simple matter: Plane waves, polarization, energy and momentum, reflection and transmission; *Waves in conductors and dispersive matter:* frequency dependence, dispersion, Drude model, Lorentz model, propagation of wave packets; *Guided waves:* waveguides, coaxial transmission lines, resonant cavities

III. Potentials and Fields

Potential formulation of Maxwell's equations, gauge transformations, retarded potentials and fields, potentials and fields of a moving point charge

IV. Electromagnetic Radiation

Radiation zones, electric dipole radiation, magnetic dipole and quadrupole radiation, angular distribution of multipole radiation

V. Special Relativity

Lorentz transformations, relativistic electrodynamics, covariant formulation of electrodynamics

Text: J. D. Jackson, *Classical Electrodynamics*

Reference: D. J. Griffiths, *Introduction to Electrodynamics*

A. Zangwill, *Modern Electrodynamics*

Lectures: Lectures will be given in-person, but if needed they may be delivered via zoom. The zoom link will be placed on Canvas. ***Attendance of all lectures is required.***

Lecture Notes: Lecture Notes will be provided and will cover all the material needed for the course. The Lecture Notes will be posted on Canvas in due course.

Homework: Homework will be posted on Canvas and will be normally due in a week from the day of assignment. There will be 9 assignments during the semester. All homework problems will have an equal weight of 10 points unless indicated otherwise.

Students are encouraged to discuss ideas and approaches to solve the assignment problems with other students. However, all students *are required to complete all derivations themselves. It is not allowed copying the work of others or using problem solutions obtained from any source.*

Homework is an important part of students' learning. *A student will likely fail exams if he (she) doesn't do homework assignments him(her)self.*

Students should bring homework solutions in written form to the class on the due date and put them on the instructor's desk in JH 245 before the class starts. Alternatively, students can place homework solutions in the instructor's mailbox *before the due time shown on the assignment. Delays beyond the due time are not allowed.*

Exams: All exams will be open book in class. Students are allowed to use homework solutions, lecture notes, and textbooks. *However, using internet is not allowed.* While having cell phones, laptop computers or other gadgets is not forbidden (e.g., to display lecture notes), they **must be switched to the airplane mode.** *Also, students are not allowed making electronic copies of the exam problems. Problem sheets need to be returned with the exam solutions.*

Midterm Exams: February 27, 12:30-13:20 (JH245)
April 3, 12:30-13:20 (JH245)
May 1, 12:30-13:20 (JH245)

Final Exam: May 17, 15:30-17:30 (JH245)

Performance in class reflects student's contribution to the everyday work in the classroom. All students are expected to participate in discussions, answer and ask questions, i.e., be active during the class time.

Grading

Homework	30%
Midterm Exams	12%
Final Exam	30%
Performance in Class	4%

Final grade

A+	A	A-	B+	B	B-	C+	C	C-	D	F
93%	85%	80%	75%	70%	65%	60%	55%	50%	40%	<40%

Ownership rights protection: Any work and/or communication that you are privy to as a member of this course should be treated as the **Intellectual Property** of the instructor and is not to be shared outside the context of this course. *Students may not make or distribute screen captures, audio/video recordings of, or livestream, any class-related activity, including lectures and presentations, without express prior written consent from the instructor.*

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the UNL's policy to provide flexible and individualized accommodation to students with disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with Services for Students with Disabilities.

UNL Course Policies and Resources: Students are responsible for knowing the university policies and resources found at <https://go.unl.edu/coursepolicies>.

Face Covering Policy: Students are required to use a facial covering at all times when indoors on the UNL campus (see <https://covid19.unl.edu/face-covering-policy> for details).