

ELECTROMAGNETIC THEORY II (PHY 302) Spring 2025

Course title:	Electromagnetic Theory II (PHY302)
Credit:	3 units
Semester:	2025 Spring
Instructor:	Sergey Syritsyn (office C-140) sergey.syritsyn[at]stonybrook.edu
Lectures:	Staller Center 3220 ; 28 lectures from Jan 27 to May 7, MoWe 8:00AM–9:20AM
Office hours:	In instructors' office (Physics C-140) or as announced; time/date TBA

Description and outline

1. **Conservation laws in electrodynamics.** Energy-momentum-stress tensor, Poynting vector, conservation of momentum and angular momentum.
2. **Electromagnetic waves in vacuum.** Wave equation, boundary conditions, reflection and transmission, polarization. Propagation in matter, absorption, and dispersion. Interaction with conductors and skin effect. Waveguides and transmission lines.
3. **Electrodynamic potentials.** Scalar and vector potentials, gauge transformation. Coulomb and Lorentz gauges. Retarded potentials. Lienard-Wiechert potentials and fields of moving charges.
4. **Radiation of electromagnetic waves.** Electric and magnetic dipole radiation. Power radiated by a point charge. Back-reaction of the radiation.
5. **Special relativity and electrodynamics.** Postulates of relativity. Space-time and Lorentz transformations. Relativistic mechanics, energy and momentum. Relativistic potentials and electromagnetic field tensor.

The material will be presented in lectures, with some extra reading assignments. Homeworks will be assigned weekly, following discussion of similar sample problems in the class. Some of the related material may be presented exclusively in class.

Main textbooks (recommended reading)

1. Griffiths *"Introduction to Electrodynamics"*.
2. (optional reading) Landau, Lifshitz *"The Classical Theory of Fields"*.

Assessing performance (course score)

- Homeworks: 30% (anticipate 10 assignments requiring 6-8 hours weekly)
- Midterms 1 and 2: 20% + 20%
- Final exam: 30%

Grade determination

- $90\% \leq A-, A \leq 100\%$
- $75\% \leq B-, B, B+ < 90\%$
- $60\% \leq C, C+ < 75\%$
- $50\% \leq D < 60\%$
- $F < 50\%$

(The above are anticipated grade thresholds; these thresholds may be lowered based on the difficulty of the midterm and final exams)

Homeworks

Homeworks will be posted weekly on Mondays (Brightspace), due in class one week after posting. Late submissions will be deducted 20% of the grade per day. Model solutions posted about five days after the due date. Discussions and group work are encouraged, but each student will be expected to provide *individually written solutions*; noticeable similarities will result in reduced grades.

Exams

- Midterm exams: (tentative) Mar 12 and Apr 14 in class
- Final: May 21 (Wed) 08:00–10:45AM

Exams are closed-book; students are encouraged to compose one letter-size sheet of formula notes.

Student Accessibility Support Services (SASC):

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631)632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

<https://www.stonybrook.edu/commcms/studentaffairs/sasc/facstaff/syllabus.php>

Academic Integrity Statement:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at:

http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management Statement

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.