Fall 2020

PHYS 621-101: Classical Electromagnetism I

Slawomir Piatek

COURSE OUTLINE **PHYSICS 621** **Fall 2020**

Classical Electromagnetism I

Online

https://njit.webex.com/meet/piateknjit.edu

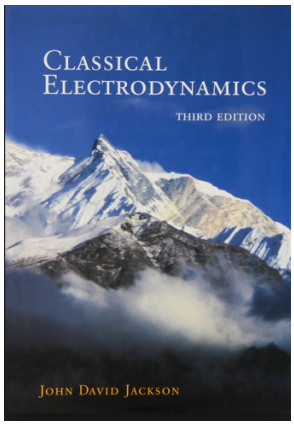
INSTRUCTOR: Slawomir Piatek: 423F Tiernan Hall, **piatek@njit.edu**

OFFICE HOURS: M & Th 1:00 PM – 2:00 PM; other times by appointment.

PREREQUISITE: Undergraduate course in electromagnetism

COURSE MATERIAL:

- Textbook: *Jackson, J. D., "Classical Electrodynamics", 3rd edition, J. Wiley*



/**ATTENDANCE:** It is expected that students will attend all lectures. Attendance will be taken at all classes. More than 3 unexcused absences (in total) are excessive. If you have excusable absences contact the Dean of Students. If you must withdraw from the course, do it officially through the Registrar. Do not simply stop attending and taking exams: that forces the instructor to assign a course grade of "F."

GRADING: Your final letter grade in Phys 621 will be based on a composite score for term's work that includes the the scores for lecture quizzes, midterm, and the final exam.

1) Lecture quizzes: Starting on 9/10, a lecture quiz will be given by the end of class. The quiz will contain 1 – 5 problems depending on the level of difficulty. The quizzes will be "open textbook" but "closed notes." Solution to a quiz will be posted on the class website and discussed in the following class.

2) Midterm: Thursday, October 22. The midterm will contain three problems covering chapters 1 – 3. The format is "open textbook" but "closed notes."

3) Final Exam: Thursday, December 17, 6:00 PM – 8:30 PM. The final will contain three problems covering chapters 4 – 6. The format is "open textbook" but "closed notes."

Final Letter Grades: Here are the weights to be used for calculating the composite score:

- **40%** for the total of all lecture quizzes
- **30%** for the midterm
- **30%** for the final

The cutoff percentages for various letter grades will be in the range of:
85% for A
80% for B+
70% for B
65% for C+
50% for C
40% D
F below 40 %

STUDENTS WITH DISABILITIES:

If you need accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services, Fenster Hall Room 260 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

HONOR CODE STATEMENT: NJIT has a zero-tolerance policy for cheating of any kind and for student behavior that disrupts learning by others. Violations will be reported to the Dean of Students. The penalties range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT. Avoid situations where your own behavior could be misinterpreted as dishonorable. **Students are required to agree to the NJIT Honor Code on each exam, assignment, quiz, etc. for the course.**

Turn off all cellular phones, wireless devices, computers, and messaging devices of all kinds during classes and exams. Please do not eat, drink, or create noise in class that interferes with the work of other students or instructors. Creating noise or otherwise interfering with the work of the class will not be tolerated.

LEARNING OUTCOMES

1. Recognize electric and magnetic phenomena as a coherent whole, both in their physical basis and in the mode of mathematical description.
2. Formulate and solve problems in electrostatics.
3. Implement a number of methods of mathematical physics to find the solution of Boundary-Value problems, including Green's theorems, Green functions, Orthonormal expansions, Spherical harmonics, and cylindrical and spherical Bessel functions.
4. Perform multipolar expansion evaluation of the electrostatic potential and the charge distribution
5. Solve Boundary-Value problems in the presence of Dielectric materials.
6. Describe the main features of Magnetostatics.
7. Perform calculations of magnetic fields and magnetic vector potentials in a variety of situations, including magnetic materials. Implement a multipolar expansion study of magnetic properties of a localized current distribution.
8. Describe Maxwell Equations of electromagnetism. Explain the importance of gauge transformations. Identify the electromagnetic wave equation, and the corresponding retarded and advanced Green functions. Recognize the transformation properties of the electromagnetic fields and sources under rotations, spatial reflection and time reversal. Analyze the conservation of energy and momentum for a system of charged particles and electromagnetic fields with the help of Poynting's theorem.
9. Describe the propagation of plane electromagnetic waves.

Class Calendar

TOPIC	TEXT STUDIES	RECOMMENDED PRACTICE PROBLEMS
Week 1 (9/3/20) Introduction to electrostatics	Ch. 1.1 – 1.5	Jackson, 1.1, 1.3, 1.4, 1.5
Week 2 (9/10/20) Introduction to electrostatics	Ch. 1.6 – 1.11	Jackson, 1.6, 1.7, 1.8, 1.9
Week 3 (9/17/20) Boundary-Value Problems, I	Ch. 2.1 – 2.7	Jackson, 2.1, 2.2, 2.4, 2.5
Week 4 (9/24/20) Boundary-Value Problems, I	Ch. 2.8 – 2.11	Jackson, 2.9, 2.10, 2.11, 2.13
Week 5 (10/1/20) Boundary-Value Problems, II	Ch. 3.1 – 3.3, 5-6	Jackson, 3.1, 3.2, 3.3
Week 6 (10/8/20) Boundary-Value Problems, II	Ch. 3.7 – 3.10	Jackson, 3.6, 3.7, 3.14
Week 7 (10/15/20) Boundary-Value Problems, II (cont'd) Multipoles, Electrostatics of Macroscopic Media, Dielectrics	Ch. 3.7 – 3.10; 4.1 – 4.4	Jackson, 4.1, 4.7, 4.8
Week 8 (10/22/20) Multipoles, Electrostatics of Macroscopic Media, Dielectrics, cont'd Midterm (Chs 1 – 3)	Ch. 4.1 – 4.4	
Week 9 (10/29/20) Multipoles, Electrostatics of Macroscopic Media, Dielectrics	Ch. 4.4, 4.7	Jackson, 4.9, 4.10
Week 10 (11/5/20) Magnetostatics	Ch. 5.1 – 5.3	Jackson, 5.1, 5.2, 5.3
Week 11 (11/12/20) Magnetostatics	Ch. 5.4 – 5.7	Jackson, 5.8, 5.11, 5.12
Week 12 (11/19/20) Magnetostatics	Ch. 5.8 – 5.12, 5.15 – 5.17	Jackson, 5.18, 5.25, 5.30
Week 13 (12/3/20) Maxwell Equations	Ch. 6.1 – 6.5	Jackson, 6.4, 6.8
Week 14 (12/10/20) Maxwell Equations	Ch. 6.6 – 6/10	Jackson, 6.9, 6.14