

# CLASSICAL ELECTRODYNAMICS I

Physics 6/75203

SPRING 2013

## INSTRUCTOR:

Dr. Mark Manley    manley@kent.edu  
220 Smith Hall    <http://www.kent.edu/CAS/Physics/people/manley.cfm>  
330-672-2407

**CLASS HOURS:**    1:10 - 2:00 M W F, 111 Henderson Hall

**OFFICE HOURS:**    3:30 - 4:30 M W  
                              3:00 - 4:00 T  
                              11:10 - 12:00 R  
                              (or by appointment)

**TEXT:** *Classical Electrodynamics*, third edition, by John David Jackson (Wiley).

**PREREQUISITE:** Special Approval. Students who do have the proper prerequisites risk being deregistered from the class.

**STUDENT LEARNING OUTCOMES:** Upon successful completion of this course, students will be able to:

- Solve boundary-value problems in electrostatics in a variety of coordinate systems.
- Demonstrate a basic understanding of Green Functions and their applications
- Solve problems using special functions, such as Bessel functions and Legendre polynomials.
- Have a basic understanding of magneto-statics.

|                             |            |     |
|-----------------------------|------------|-----|
| <b>GRADE DETERMINATION:</b> | Homework   | 20% |
|                             | Exam 1     | 25% |
|                             | Exam 2     | 25% |
|                             | Final Exam | 30% |

**HOMEWORK:** Problems will be assigned in class. Homework assignments *must* be handed in on time.

**EXAMS:** Each of the two midterm exams will cover only those chapters of the text that were covered in class since the previous exam. The final exam will be comprehensive.

**COVERAGE:** As indicated on the tentative course outline.

**MAKEUP CLASSES:** I anticipate being away occasionally because of research commitments. Make-up classes will be scheduled as needed.

## **CHEATING AND PLAGIARISM:**

University policy 3342-3-01.8 deals with the problem of academic dishonesty, cheating, and plagiarism. None of these will be tolerated in this class. The sanctions provided in this policy will be used to deal with any violations. If you have any questions, please read the policy at [http://www.kent.edu/policyreg/-policydetails.cfm?customel\\_datapageid\\_1976529=2037779](http://www.kent.edu/policyreg/-policydetails.cfm?customel_datapageid_1976529=2037779) and/or ask.

## **STUDENTS WITH DISABILITIES:**

University policy 3342-3-01.3 requires that students with disabilities be provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact the instructor at the beginning of the semester to make arrangements for necessary classroom adjustments. Please note, you must first verify your eligibility for these through Student Accessibility Services (contact 330-672-3391 or visit [www.kent.edu/sas](http://www.kent.edu/sas) for more information on registration procedures).

## **REGISTRATION REQUIREMENT:**

The official registration deadline for this course is January 27, 2003. The course withdrawal deadline is March 24, 2013. University policy requires all students to be officially registered in each class they are attending. Students who are not officially registered for a course by published deadlines should not be attending classes and will not receive credit or a grade for the course. Each student must confirm enrollment by checking his/her class schedule (using Student Tools in FlashFast) prior to the deadline indicated. Registration errors must be corrected prior to the deadline.

## TENTATIVE COURSE OUTLINE:

| Week | Date   | Day | Tentative Schedule                                   |
|------|--------|-----|------------------------------------------------------|
| 1    | Jan 14 | M   | Ch. 1—Coulomb's Law, Gauss' Law, the Electric Field  |
|      | Jan 16 | W   | Ch. 1—Divergence Theorem and Stoke's Theorem         |
|      | Jan 18 | F   | Ch. 1—Poisson and Laplace Equations; Green's Theorem |
| 2    | Jan 21 | M   | MLK Jr. Day—No Class                                 |
|      | Jan 23 | W   | Ch. 1—Continued                                      |
|      | Jan 25 | F   | Ch. 1—Continued                                      |
| 3    | Jan 28 | M   | Ch. 1—Potential Energy, Energy Density, Capacitance  |
|      | Jan 30 | W   | Ch. 2—Boundary-Value Prob.; Method of Images         |
|      | Feb 1  | F   | Ch. 2—Orthogonal Functions and Fourier Expansions    |
| 4    | Feb 4  | M   | Ch. 2—Separation of Variables                        |
|      | Feb 6  | W   | Ch. 3—Laplace's Eq. in Spher. Coord.; Legendre Poly. |
|      | Feb 8  | F   | Ch. 3—Boundary-Value Prob. with Azimuthal Symmetry   |

## TENTATIVE COURSE OUTLINE (Continued):

| Week | Date   | Day | Tentative Schedule                                    |
|------|--------|-----|-------------------------------------------------------|
| 5    | Feb 11 | M   | Ch. 3—Spherical Harmonics and Assoc. Legendre Func.   |
|      | Feb 13 | W   | Ch. 3—Laplace's Eq. in Cyl. Coord.; Bessel Func.      |
|      | Feb 15 | F   | Ch. 3—Green Function Expansions                       |
| 6    | Feb 18 | M   | Ch. 4—Multipole Expansions                            |
|      | Feb 20 | W   | Ch. 4—Electric Polarization and Displacement          |
|      | Feb 22 | F   | Ch. 4—Boundary-Value Problems with Dielectrics        |
| 7    | Feb 25 | M   | Ch. 4—Molecular Polarizability; Elect. Susceptibility |
|      | Feb 27 | W   | Ch. 4—Continued                                       |
|      | Mar 1  | F   | Exam 1 (Chapters 1 and 2)                             |
| 8    | Mar 4  | M   | Ch. 5—Magnetostatics; Biot and Savart Law             |
|      | Mar 6  | W   | Ch. 5—Continued                                       |
|      | Mar 8  | F   | Ch. 5—Continued                                       |
| 9    | Mar 11 | M   | Ch. 5—Gauss' Law for Magnetism and Ampère's Law       |
|      | Mar 13 | W   | Ch. 5—The Vector Potential                            |
|      | Mar 15 | F   | Ch. 5—Current Distributions; Magnetic Moments         |
| 10   | Mar 18 | M   | Ch. 5—Continued                                       |
|      | Mar 20 | W   | Ch. 5—Magnetic Field; Boundary-Value Problems         |
|      | Mar 22 | F   | Ch. 6—Faraday's Law of Induction                      |
| 11   | Mar 25 | M   | Spring Break—No Class                                 |
|      | Mar 27 | W   | Spring Break—No Class                                 |
|      | Mar 29 | F   | Spring Break—No Class                                 |

## TENTATIVE COURSE OUTLINE (Continued):

| Week | Date   | Day | Tentative Schedule                          |
|------|--------|-----|---------------------------------------------|
| 12   | Apr 1  | M   | Ch. 6—Energy in the Magnetic Field          |
|      | Apr 3  | W   | Ch. 6—The Maxwell Equations                 |
|      | Apr 5  | F   | Exam 2 (Chapters 3 and 4)                   |
| 13   | Apr 8  | M   | Ch. 6—Gauge Invariance of Electromagnetism  |
|      | Apr 10 | W   | Ch. 6—Green Functions for the Wave Equation |
|      | Apr 12 | F   | Ch. 6—Poynting's Theorem                    |
| 14   | Apr 15 | M   | Ch. 6—Continued                             |
|      | Apr 17 | W   | Ch. 6—Continued                             |
|      | Apr 19 | F   | Ch. 6—Continued                             |
| 15   | Apr 22 | M   | Ch. 6—The Duality Transformation            |
|      | Apr 23 | W   | Catch-up Day                                |
|      | Apr 25 | F   | Catch-up Day                                |
| 16   | Apr 29 | M   | Catch-up Day                                |
|      | May 1  | W   | Catch-up Day                                |
|      | May 3  | F   | Catch-up Day                                |
| 17   | May 6  | M   | Final Exam (10:15–12:30 p.m.)               |