PHYS 382 Electromagnetism II — Spring 2015

Instructor: Dr. Dmitri Tenne;
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Office Hours: Tu., Th., 10:30 am – 12:00 pm
Homework/reading assignments: blackboard.boisestate.edu

Classroom: MP-207A; Time: MWF 4:30 pm – 5:45 pm
Prerequisites: PHYS 381

Required preparation: thorough understanding and ability to use vector calculus, including gradient, divergence, curl, and laplacian in cartesian, cylindrical, and spherical coordinates; mastery of all electrostatics and magnetostatics concepts and techniques from PHYS 381.

3rd edition is acceptable, but homework assignments will be based on the 4th edition.

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<th>Week</th>
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<th>Topics</th>
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<td><strong>Part 1:</strong> Electrodynamics and Conservation Laws</td>
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| 1. | 1/12 | Ohm’s Law; EMF, Faraday’s Law;  
Reading: 7.1.1 (296–302); 7.1.2–7.1.3 (303–310); 7.2.1–7.2.2 (312–320) |
| 2. | 1/19 | (Holiday) Inductance; Magnetic Field Energy  
Reading: 7.2.3 (321–326); 7.2.4 (328–331) |
| 3. | 1/26 | Maxwell’s Equations in Vacuum; Maxwell’s Equations in Matter; Boundary Conditions  
Reading: 7.3.1–7.3.3 (332–339); 7.3.5 (340–342); 7.3.6 (342–344) |
| 4. | 2/2 | Poynting’s Theorem; Maxwell Stress Tensor; Momentum and Angular Momentum  
Reading: 8.1 (356–360); 8.2.1–8.2.2 (360–366); 8.2.3–8.2.4 (366–372) |
| 5. | 2/9 | Review; **EXAM 1 (Wed Feb 11)**; Wave Equation;  
Reading: review chaps. 7–8 (296–378); 9.1.1 (382–385). |

**Part 2:** Electromagnetic Waves

| 6. | 2/16 | (Holiday); Sinusoidal Waves; Boundary Conditions and Polarization  
Reading: 9.1.2 (385–388); 9.1.3–9.1.4 (388-393) |
| 7. | 2/23 | EM Plane Waves; Energy and Momentum in EM Waves; EM Waves in Linear Media  
Reading: 9.2.1–9.2.2 (393–398); 9.2.3 (398–400); 9.3.1–9.3.2 (401–405) |
| 8. | 3/2 | Geometric Optics; Reflection and Transmission; EM Waves in Conductors  
Reading: 9.3.3 (405–411); 9.4.1 (412–416), 9.4.2 (416–417), |
9.  3/9   Reflection;  Permittivity and Frequency;  Wave Guides  
    *Reading:*  9.4.3 (417–424);  9.5.1 (425–427), 9.5.2–9.5.3 (428–431)

3/16   (March 20 is the last day to drop with a W.)  
      Review;  EXAM 2 (Wed, Mar. 18):  Potentials and Gauges;  
      *Reading:*  Chap. 9 (382–431): Exam 2;  10.1 (436–442)

10.  3/23   SPRING BREAK (3/23–3/29)

Part 3:  Potentials and Fields, Radiation, and Relativity  
(Exam 3 over Chapters 10-12)

11.  3/30   Retarded potentials;  Point-Charge Potentials;  Moving Point Charge  
      *Reading:*  10.2 (444–450);  10.3.1 (451–456);  10.3.2 (456–462)

12.   4/6    Electric Dipole Radiation;  Magnetic Dipole Radiation;  Radiation from an  
            Arbitrary Source  
            *Reading:*  11.1.1–11.1.2 (466–473);  11.1.3 (473–477);  11.1.4 (477–482)

13.   4/13   Radiation by Point Charge;  Radiation Reaction;  Special Relativity  
            *Reading:*  11.2.1 (482–487);  11.2.2–11.2.3 (488–496);  12.1.1–12.1.2 (502–518)

14.   4/20   Spacetime:  Relativistic Mechanics;  Magnetic Forces  
            *Reading:*  12.1.3–12.1.4 (519–531);  12.2.1–12.2.3 (532–542);  12.2.4–12.3.1  
            (542–552)

15.   4/27   Field Transformations;  Field Tensor;  Review  
            *Reading:*  12.3.2 (553–562);  12.3.3–12.3.5 (562–570);  Review Chaps. 10-12 (436-570)

EXAM 3 (Wed, May 6,  3:00 pm – 5:00 pm)

**GOALS:** To obtain a basic understanding of the key concepts of electrodynamics based on Maxwell’s Equations, using the formalism of vector calculus throughout, and to prepare students for graduate-level electrodynamics. The course objectives will be accomplished through lecture and discussion of selected topics in class, and by students working through the assigned parts of text, including textbook examples and assigned homework problems. Assessment will come from exams and assigned homework.

**SCHEDULE:** The schedule describes the intended progression of the course. It can be revised as needed. Changes to the schedule and the homework assignments will be posted on the Blackboard, which should be checked frequently for updates.

**EXAMS:** 90% of your grade is based on the exams. The exams are based on the textbook readings, the numbered examples in the text, the homework, extra-credit problems, and the class lectures. ALL EXAMS WILL BE COUNTED, AND NO MAKE-UP EXAMS WILL BE GIVEN. There will be three exams, worth 30% each. Only simple scientific calculators allowed during exams: no
calculators that are capable of graphing, integration, differentiation, or symbolic algebra are allowed. You may bring one 8.5” by 11” sheet of formulas for each exam, with formulas on both sides, plus the formula sheets from your previous PHYS 381 exams. All formula sheets must be labeled at the top with your name and the exam number, be signed and handwritten by you, and be turned in with your exam. It is your responsibility to know the meaning of every symbol on your formula sheet, and to understand the meaning, applicability, and use of every equation that you include on your formula sheet.

HOMEWORK: 10% of your grade is based on the homework. Hand in what you have on the due date, at the beginning of class. NO LATE HOMEWORK ACCEPTED. Start homework assignments early (ASAP) because they may be challenging and time-consuming. Homework problems will form the basis for many of the exam problems. Look over your graded homework carefully and make sure you can work and understand every assigned homework problem. You are strongly encouraged to talk to the instructor about homework problems that you do not understand.

LECTURES & ASSIGNED READINGS: Class lectures relate closely to the assigned readings in the text. Students are expected to attend all lectures and participate actively in class. Consult the syllabus and read the assigned pages before and after the material is covered in class. Carefully work through all numbered examples in the assigned reading. As you read, write down any questions you have about the reading and the numbered examples, and ask the questions in class.

ACADEMIC HONESTY: Although you are encouraged to discuss the class lectures, readings, and assignments with your classmates, all work that you turn in must be your own. NO CHEATING OR PLAGIARISM (PRESENTING OTHER PEOPLE’S WORK AS IF IT WERE YOUR OWN) WILL BE TOLERATED, INCLUDING ANY USE OF HOMEWORK SOLUTIONS FOUND ON THE WEB. If you make use of any sources besides the class lectures or textbooks, you must provide explicit written references to the sources you use. Failure to follow this rule or any others listed in the Student Code of Conduct could have drastic consequences, including (but not limited to) ejection from the course with a failing grade.

GRADING: A: 88 – 100% (A-: 88.0–89.9%, A+: 99.0-100%)  
B: 75.0 – 87.9% (B-: 75.0–77.9%, B+: 86.0–87.9%); 
C: 60.0 – 74.9% (C-: 60.0-62.9%, C+: 72.0–74.9%); D: 45.0–59.9%.  