

Spring 2-1-2017

# PHSX 425.01: Electricity and Magnetism II

Eijiro Uchimoto

*University of Montana - Missoula*, [eijiro.uchimoto@umontana.edu](mailto:eijiro.uchimoto@umontana.edu)

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# PHYSICS 425 – ELECTRICITY AND MAGNETISM II Spring Semester 2017

## LECTURES

Mon., Wed., & Fri. 1:00 p.m. – 1:50 p.m., CHCB 231

In addition, I will give a series of twelve optional lectures (Tue. 12 noon – 12:50 p.m., CHCB 231) summarizing most of the topics to be covered in PHSX 425.

## INSTRUCTOR

Eijiro ('Ebo') Uchimoto

Office: CHCB 127 (Tel. No. 243-6223)

Email: [eijiro.uchimoto@umontana.edu](mailto:eijiro.uchimoto@umontana.edu)

Office Hours: Mon. 9 – 10 a.m., Tue. 10 – 11 a.m., Wed. 3 – 4 p.m., Thu. 1 – 2 p.m.,  
Fri. 4 – 5 p.m. (and by appointment)

## SCOPE

- Electrostatics and magnetostatics in matter
- Electrodynamics including induction, electromagnetic waves, and radiation
- Conservation laws, potential formulation, and four vectors

## OUTCOME

- Will acquire physical understanding and working knowledge of electrostatics and magnetostatics in matter
- Will acquire physical understanding and working knowledge of electrodynamics including induction, electromagnetic waves, and radiation
- Will be fully exposed to conservation laws, potential formulation, and four vectors

## NUMBER OF CREDITS

3 credits

## PREREQUISITE

PHSX 423 – Electricity and Magnetism I

## TEXTBOOK

Introduction to Electrodynamics, 4<sup>th</sup> ed. by David J. Griffiths  
(Prentice Hall, 2013) ISBN 978-0-321-85656-2

## HOMEWORK

Reading assignments and problem sets

## EXAMS

Three midterm exams (**FRI. 2/24, Fri. 3/31, Fri. 4/28**)

One final exam (**3:20 p.m. – 5:20 p.m. on Thu. 5/11**)

## COURSE GUIDELINES AND POLICIES

### Student Conduct Code

The Student Conduct Code at the University of Montana embodies and promotes honesty, integrity, accountability, rights, and responsibilities associated with constructive citizenship in our academic community. This Code describes expected standards of behavior for all students, including academic conduct and general conduct, and it outlines students' rights, responsibilities, and the campus processes for adjudicating alleged violations. Full student conduct code. [http://www.umt.edu/vpsa/policies/student\\_conduct.php](http://www.umt.edu/vpsa/policies/student_conduct.php)

### Course Withdrawal

Students may use Cyberbear to drop courses through the first 15 instructional days of the semester. Beginning the 16<sup>th</sup> instructional day of the semester through the 45<sup>th</sup> instructional day, students use paper forms to drop, add and make changes of section, grading option or credit. PHSX 425 may not be taken as credit/no-credit.

### Disability Modifications

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or call 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

### Grading Policy

Your grade will be based on the following:

Problem sets:	25%
Midterm exams:	45% (15% each)
Final exam:	30%

Typical cutoffs for the final course grade:

A-/B+	82%
B-/C+	70%
C-/D+	58%
D-/F	45%

## TENTATIVE COURSE OUTLINE

Date	Topics
<b>Week 1: Jan 23, 25, 27</b>	Force and torque on an electric dipole, polarization, electric field due to a polarized object, bound charges (Griffiths Sections 4.1 & 4.2)
<b>Week 2: Jan 30, Feb 1, 3</b>	Electric displacement, linear dielectrics (Griffiths Section 4.3 & 4.4)
<b>Week 3: Feb 6, 8, 10</b>	Force and torque on a magnetic dipole, magnetization, magnetic field due to a magnetized object, bound currents (Griffiths Sections 6.1, 6.2 & 6.3)
<b>Week 4: Feb 13, 15, 17</b>	The H field, linear and nonlinear media (Griffiths Section 6.4)
<b>Week 5: Feb 22, 24</b>	Ferromagnetism (Griffiths Section 6.4) <b>EXAM #1 (2/24)</b>
<b>Week 6: Feb 27, Mar 1, 3</b>	Ohm's law, electromotive force Electromagnetic induction, inductance, magnetic energy, Maxwell's equations in vacuum (Griffiths Sections 7.1 & 7.2)
<b>Week 7: Mar 6, 8, 10</b>	Maxwell's equations in matter Conservation of charges and energy (Griffiths Sections 7.3, 8.1 & 8.2)
<b>Week 8: Mar 13, 15, 17</b>	Maxwell's stress tensor, conservation of momentum No work done by magnetic field (Griffiths Sections 8.2 & 8.3)
<b>SPRING VACATION WEEK (Mar 20 – 24)</b>	
<b>Week 9: Mar 27, 29, 31</b>	Electromagnetic waves in vacuum (Griffiths Section 9.1, 9.2) <b>EXAM #2 (3/31)</b>
<b>Week 10: Apr 3, 5, 7</b>	Electromagnetic waves in matter Fresnel equations Absorption and dispersion (Griffiths Sections 9.3 & 9.4)
<b>Week 11: Apr 10, 12, 14</b>	Introduction to wave guides Potential formulation (Griffiths Sections 9.5 & 10.1)
<b>Week 12: Apr 17, 19, 21</b>	Retarded potentials, Lienard-Wiechert potentials (Griffiths Sections 10.2 & 10.3)
<b>Week 13: Apr 24, 26, 28</b>	Selected topics from radiation and relativity (TBD) <b>EXAM #3 (4/28)</b>
<b>Week 14: May 1, 3, 5</b>	More on relativity, review (TBD)
<b>Week 15: May 11</b>	<b>FINAL EXAM (5/11)</b>