

# PHYSICS 425 – ELECTRICITY AND MAGNETISM II

Spring Semester 2020

## LECTURES

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

## INSTRUCTOR

Eijiro ('Ebo') Uchimoto

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Office Hours: Mon. 9 – 10 a.m., Tue. 2 – 3 p.m., Wed. 3 – 4 p.m., Thu. 10 – 11 a.m.,  
Fri. 2 – 3 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 (**Mon. 2/10, Wed. 3/11, Mon. 4/20**)

One final exam (**3:20 p.m. – 5:20 p.m. on Thu. 5/7**)

## 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](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 13, 15, 17</b>	Force and torque on an electric dipole, polarization, electric field due to a polarized object, bound charges, electric displacement (Griffiths Sections 4.1, 4.2 & 4.3)
<b>Week 2: Jan 22, 24</b> (no class on Jan 20 - M.L. King Jr. Day)	Linear dielectrics (Griffiths Section 4.4) Force and torque on a magnetic dipole, magnetization Magnetic field due to a magnetized object (Griffiths Sections 6.1, 6.2 & 6.3)
<b>Week 3: Jan 27, 29, 31</b>	Bound currents, the H field, linear media (Griffiths Sections 6.3 & 6.4)
<b>Week 4: Feb 3, 5, 7</b>	Nonlinear media, ferromagnetism (Griffiths Section 6.4) Ohm's law, electromotive force (Griffiths Section 7.1)
<b>Week 5: Feb 10, 12, 14</b>	<b>EXAM #1</b> (Mon 2/10) Electromagnetic induction, inductance, magnetic energy (Griffiths Section 7.2)
<b>Week 6: Feb 19, 21</b> (no class on Feb 17 - Presidents' Day)	Maxwell's equations in vacuum and matter Introduction to conservation laws (Griffiths Sections 7.3 & 8.1)
<b>Week 7: Feb 24, 26, 28</b>	Conservation of charges and energy Maxwell's stress tensor, conservation of momentum No work done by magnetic field (Griffiths Sections, 8.1, 8.2 & 8.3)
<b>Week 8: Mar 2, 4, 6</b>	Electromagnetic waves in vacuum and in media (Griffiths Sections 9.1, 9.2)
<b>Week 9: Mar 9, 11, 13</b>	<b>EXAM #2</b> (Wed. 3/11)  Intro to Fresnel equations (Griffiths Sections 9.3 & 9.4)
<b>SPRING VACATION WEEK (Mar 16 – 20)</b>	
<b>Week 10: Mar 23, 25, 27</b>	More on Fresnel equations Absorption and dispersion (Griffiths Sections 9.3 & 9.4)
<b>Week 11: Mar 30</b> <b>Apr 1, 3</b>	More on absorption and dispersion Potential formulation (Griffiths Section 9.4 & 10.1)
<b>Week 12: Apr 6, 8, 10</b>	Choice of gauge Retarded potentials (Griffiths Section 10.2)
<b>Week 13: April 13, 15, 17</b>	Lienard-Wiechert potentials (Griffiths Sections 10.3 & 11.1) Introduction to radiation

<b>Week 14: April 20, 22, 24</b>	<b>EXAM #3</b> (Mon. 4/20)
	Radiation (Selected sections from Chapter 11)
<b>Week 15: April 27, 29 May 1</b>	E&M and relativity (Selected sections from Chapter 12)
	Review
<b>Week 16: May 7</b>	<b>FINAL EXAM</b> (Thu. 5/7)