

# PHYSICS 423 – ELECTRICITY AND MAGNETISM I Autumn Semester 2018

## 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. 10 – 11 a.m., Tue. 2 - 3 p.m., Wed. 3 – 4 p.m., Thu. 1 – 2 p.m.,  
Fri. 11 a.m. – 12 noon (and by appointment)

## SCOPE

- Development of mathematical tools for electromagnetic theory
- Overview of electromagnetic theory including Maxwell's equations and the potential formulation
- Detailed studies of electrostatics and magnetostatics

## OUTCOME

- Will be proficient in vector analysis including the use of curvilinear coordinates and the Dirac delta function
- Will be exposed to full electromagnetism including scalar and vector potentials
- Will have acquired physical understanding and working knowledge of electrostatics and magnetostatics

## NUMBER OF CREDITS

3 credits

## PREREQUISITE

PHSX 301 – Introduction to Theoretical Physics

## 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. 9/24, Fri. 10/26, Mon. 12/4)

Final exam (1:10 p.m. – 3:10 p.m. on Wed. 12/12)

## 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 423 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: Aug 27, 29, 31</b>	Overview of electromagnetic theory Review of vector analysis (Griffiths Sections 1.1, 1.2 & 1.3)
<b>Week 2: Sept 5, 7</b>	Curvilinear coordinates (Griffiths Section 1.4 & Appendix A) 1/r potential (Sept 3 – No class Labor Day)
<b>Week 3: Sept 10, 12, 14</b>	Dirac delta function Helmholtz theorem Maxwell's equations (Griffiths Section 1.5, 1.6, Appendix B & Section 7.3 7.3)
<b>Week 4: Sept 17, 19, 21</b>	Wave equations Potential formulation (Griffith Sections 9.2 & 10.1)
<b>Week 5: Sept 24</b>	<b>EXAM #1</b>
<b>Sept 26, 28</b>	Coulomb's law, electric fields (Griffiths Section 2.1)
<b>Week 6: Oct 1, 3, 5</b>	Gauss's law Electric potential (Griffiths Sections 2.2 & 2.3)
<b>Week 7: Oct 8, 10, 12</b>	Boundary conditions, conductors Laplace's equation (Griffiths Sections 2.3, 2.4 & 2.5)
<b>Week 8: Oct 15, 17, 19</b>	Image method Separation of variables in Cartesian and spherical coordinates (Griffiths Sections 3.1, 3.2 & 3.3)
<b>Week 9: Oct 22, 24</b>	More on separation of variables (Griffiths Section 3.3)
<b>Oct 26</b>	<b>EXAM #2</b>
<b>Week 10: Oct 29, 31 Nov 2</b>	Magnetic fields, the Lorentz force law, currents (Griffiths Sections 5.1)
<b>Week 11: Nov 5, 7, 9</b>	Biot-Savart law, Ampere's law (Griffiths Sections 5.2 & 5.3)
<b>Week 12: Nov 14, 16</b>	Multipole expansion in electrostatics (Griffiths Sections 3.4) (Nov 12 – No class, Veterans Day)
<b>Week 13: Nov 19</b>	More on multipole expansion in electrostatics (Griffiths Section 3.4)  THANKSGIVING BREAK (Nov. 21 – 25)
<b>Week 14: Nov 26, 28, 30</b>	Multipole expansion in magnetostatics (Griffiths Section 5.4) Dipole electric and magnetic fields
<b>Week 15: Dec 4 Dec 6 Dec 8</b>	<b>EXAM #3</b> Introduction to electric and magnetic fields in matter Review
<b>Week 16: Dec 12</b>	<b>FINAL EXAM</b>