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### PHSX 423.01: Electricity and Magnetism I

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# PHYSICS 423 – ELECTRICITY AND MAGNETISM I Autumn Semester 2016

## LECTURES

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

## INSTRUCTOR

Eijiro ('Ebo') Uchimoto

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

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

Office Hours: Mon. 10 – 11 a.m., Tue. 12 noon - 1 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. 9/26, Fri. 10/28, Mon. 12/5)

Final exam (1:10 p.m. – 3:10 p.m. on Fri. 12/16)

## 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 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 29, 31 Sept 2</b>	Overview of electromagnetic theory Review of vector analysis (Griffiths Sections 1.1, 1.2 & 1.3)
<b>Week 2: Sept 7, 9</b>	Curvilinear coordinates 1/r potential (Griffiths Section 1.4 & Appendix A)
<b>Week 3: Sept 12, 14, 16</b>	Dirac delta function Helmholtz theorem Maxwell's equations (Griffiths Sections 1.5, 1.6, Appendix B, & Section 7.3)
<b>Week 4: Sept 19, 21, 23</b>	Wave equations Potential formulation (Griffiths Sections 9.2 & 10.1)
<b>Week 5: Sept 26 Sept 28, 30</b>	<b>EXAM #1</b> Coulomb's law, electric fields (Griffiths Section 2.1)
<b>Week 6: Oct 3, 5, 7</b>	Gauss's law Electric potential (Griffiths Sections 2.2 & 2.3)
<b>Week 7: Oct 10, 12, 14</b>	Boundary conditions, conductors Laplace's equation (Griffiths Sections 2.3, 2.4 & 2.5)
<b>Week 8: Oct 17, 19, 21</b>	Image method Separation of variables in Cartesian and spherical coordinates (Griffiths Sections 3.1, 3.2 & 3.3)
<b>Week 9: Oct 24, 26 Oct 28</b>	More on separation of variables (Griffiths Section 3.3) <b>EXAM #2</b>
<b>Week 10: Oct 31 Nov 2, 4</b>	Magnetic fields, the Lorentz force law, currents (Griffiths Sections 5.1)
<b>Week 11: Nov 7, 9</b>	Biot-Savart law, Ampere's law (Griffiths Sections 5.2 & 5.3) (Nov 11 – No class, Veterans Day)
<b>Week 12: Nov 14, 16, 18</b>	More on Ampere's law Multipole expansion in electrostatics (Griffiths Sections 5.3 & 3.4)
<b>Week 13: Nov 21</b>	More on multipole expansion in electrostatics (Griffiths Section 3.4) THANKSGIVING BREAK (Nov. 23 – 25)
<b>Week 14: Nov 28, 30 Dec 2</b>	Multipole expansion in magnetostatics (Griffiths Section 5.4) Electric fields in matter (Griffiths Section 4.1)
<b>Week 15: Dec 5 Dec 7 Dec 9</b>	<b>EXAM #3</b> More on electric fields in matter (Griffiths Section 4.2) Review
<b>Week 16: Dec 12 Dec 16</b>	Review <b>FINAL EXAM</b>