Spring 2-1-2019

PHSX 425.01: Electricity and Magnetism II

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PHYSICS 425 – ELECTRICITY AND MAGNETISM II

Spring Semester 2019

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
Office Hours: Mon. 9 – 10 a.m., Tue. 10 – 11 a.m., Wed. 3 – 4 p.m., Thu. 1 – 2 p.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, 4th ed. by David J. Griffiths

HOMEWORK
Reading assignments and problem sets

EXAMS
Three midterm exams (Wed. 2/6, Wed. 3/13, Fri. 4/19)
One final exam (3:20 p.m. – 5:20 p.m. on Tue. 4/30)
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

Course Withdrawal

Students may use Cyberbear to drop courses through the first 15 instructional days of the semester. Beginning the 16th instructional day of the semester through the 45th 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%
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<thead>
<tr>
<th>Date</th>
<th>Topics</th>
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<tbody>
<tr>
<td>Week 0: Jan 11</td>
<td>Introduction</td>
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<tr>
<td>Week 1: Jan 14, 16, 18</td>
<td>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 &amp; 4.3)</td>
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| Week 2: Jan 23, 25 (no class on Jan 21 - 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) |
| Week 3: Jan 28, 30, Feb 1 | Bound currents, the H field, linear and nonlinear media, ferromagnetism (Griffiths Sections 6.3 & 6.4) |
| Week 4: Feb 4, 6, 8 | Summary and review  
**EXAM #1** (Wed. 2/6)  
Ohm’s law, electromotive force (Griffiths Section 7.1) |
| Week 5: Feb 11, 13, 15 | Electromagnetic induction, inductance, magnetic energy (Griffiths Section 7.2) |
| Week 6: Feb 20, 22 (no class on Feb 18 - Presidents’ Day) | Maxwell’s equations in vacuum and matter  
Introduction to conservation laws (Griffiths Sections 7.3 & 8.1) |
| Week 7: Feb 25, 27, March 1 | 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) |
| Week 8: Mar 4, 6, 8 | Electromagnetic waves in vacuum and in matter (Griffiths Sections 9.1, 9.2) |
| Week 9: Mar 11, 13, 15 | Summary and review  
**EXAM #2** (Wed. 3/13) |
| Week 10: Mar 18, 20, 22 | Fresnel equations  
Absorption and dispersion (Griffiths Sections 9.3 & 9.4) |
| **SPRING VACATION WEEK** (Mar 26 – 30) | |
| Week 11: Apr 1, 3, 5 | Introduction to wave guides  
Potential formulation (Griffiths Sections 9.5 & 10.1) |
<p>| Week 12: Apr 8, 10, 12 | Selected topics from radiation (TBD) |</p>
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<tr>
<th>Week 13: April 15, 17, 19</th>
<th>E&amp;M and relativity (TBD)</th>
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<tr>
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<td><strong>EXAM #3</strong> (Fri. 4/19)</td>
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<tr>
<td>Week 14: April 22, 24, 26</td>
<td>More on E&amp;M and relativity</td>
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<tr>
<td>Week 15: April 30</td>
<td><strong>FINAL EXAM</strong> (Tue. 4/30)</td>
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