University of Wisconsin – Stevens Point

Dept. of Physics and Astronomy

Electricity and Magnetism – PHYS 320

Fall 2017

Course Information

- **Course title:** Electricity and Magnetism
- **Course number:** PHYS 320
- **Pre-requisites:** PHYS 250, Math 222.
- **Instructor:** Maryam Farzaneh
- **Contact:** B105 Science Building, x--2423, mfarzane@uwsp.edu
- **Office hours:** TWRF: 10:00 am – 11:00 am
  W: 2:00 pm – 3:00 pm

  If you cannot make any of the above office hours, please know that I have an open door policy. Please stop by as often as you wish or make an appointment by emailing me.
- **Class times:**

  - Lectures (SCI- A109) MTWF 9:00 – 9:50 am
- **Course description and objectives:** In this course, we will focus on chapters 1 to 7 of the textbook. The course objectives are:

  1. Learn and apply methods of vector calculus and other advanced mathematical methods.
  2. Learn various techniques for calculating electric potential.
  3. Understand and predict the behavior of electric and magnetic fields in vacuum and in materials.
  4. Understand and predict the behavior of time-varying fields.
  5. Understand Maxwell's equations.
- **Course alignment with the Physics and Astronomy department's Learning Objectives:** According to some of the Department of Physics and Astronomy's Learning Objectives, when graduating from UWSP, a Physics Major will be able to

  1. *Integrate conceptual reasoning, critical thinking skills, mathematical skills, and principles from both theoretical and applied physics courses to explain and solve problems related to physical processes in nature, applied mechanics, and applied electronics.* PHYS320 is a theoretical physics course, which prepares you to use critical

thinking, advanced mathematical tools and principles of the theory of electromagnetism to achieve problem-solving skills necessary to understand and explain some of the natural phenomena related to electricity and magnetism.

2. *Communicate effectively within the profession by writing clearly and concisely and by articulating clearly*. By following the Homework Guidelines provided to you, you should be able to express your thought process in solving problems clearly and effectively, so that anyone looking through your solution will be able to follow the steps easily.

Required Material

- **Textbook:** *Introduction to Electrodynamics*, David Griffiths, 4th edition, Pearson, ISBN 0-13-805326-X.

- **Calculator:** Please have a scientific calculator handy. A cell phone is *not* a scientific calculator.

- **Table of Integrals and Equation Sheet:** I will hand out a table of integrals and an equation sheet in class. Please keep it for use in class, for your homework and during the exams.

- If you are a physics major, you are required to take a 45 minutes test **"Conceptual Survey of Electricity and Magnetism"** during the first week of classes. You will receive an email from the department chair with available time slots for taking the test. Your score on this test does not affect your course grade. However, in order to pass the course, you are required to take this test. The results will help us to better assess the outcomes of our introductory E&M courses.

Lecture participation

I strongly encourage you to attend *all* the lectures and take good notes. Sometimes the lecture covers more material than you might find in your textbook. We will also try to have group problem solving exercises during some of the classes. Participating in these activities will add bonus points to your homework.

Homework

There will be one homework set per week, which is due at the beginning of the class period on the day indicated on the assignment. The solution to most of the homework problems should follow a logical step-by step approach. You should use brief sentences to describe which concepts you are using, write down any equations you are using and justify any approximation. The numerical answers should have a unit and a brief description of why it makes sense physically. Please refer to **Homework Guidelines** for more information. **.** Your homework grade is based on the completion of the assignment and the score from a few (typically four) randomly graded problems. I will post the solutions to the entire homework assignment on D2L right after the date the assignment is due. Therefore, no late homeworks are accepted. Homework counts for 20% of your final grade.

Exams

There will be *two* midterm exams during the semester, not counting your final exam. Each midterm counts for 25% of your grade. Midterm exams are tentatively scheduled for Mondays October 2, and November 13, 6:00 – 8:00 pm.

The final exam is tentatively comprehensive and scheduled for **Tuesday, December 19, 2:45 – 4:45 pm**. It counts for 30% of your grade. Overall the exams count for 80% of your grade.

General Course Policies

- **Disability services**
  UWSP is committed to providing reasonable and appropriate accommodations to students with disabilities and temporary impairments. If you have a disability or acquire a condition during the semester where you need assistance, please contact the Disability and Assistive Technology Center on the 6th floor of Albertson Hall (library) as soon as possible. DATC can be reached at 715-346-3365 or DATC@uwsp.edu.

- **Academic misconduct**
  As a student at UWSP, I expect you to be familiar with the following document: http://www3.uwsp.edu/stuaffairs/Documents/RightsRespons/SRR-2010/rightsChap14.pdf, especially Section 14.03. Simply put, *do not* copy each other's homework, lab reports and exams and pass them off as your own. Any confirmed incidence of academic misconduct, including plagiarism and other forms of cheating will be treated seriously and in accordance with University policy.

- **Since texting and cell phone use create distraction both for me as your instructor and your classmates, they are not allowed in the classroom. All cell phones should be turned off or silenced during the class and kept in your bags. No cell phone should remain in your pockets or on your desk.**
  If I see a student texting in class, I will ask him/her to leave the classroom for the remainder of the class period.

- Make-up exam will only be accepted in the case of excused absences. Excused absences include death in the immediate family, illness with a note from the appropriate health care professional, religious observance, an event in which you officially represent the University of Wisconsin-Stevens Point and the event directly conflicts with an exam. Excused absences must be approved with documenting materials prior to the date of absence.

- If you are a student-athlete and encounter a time conflict with an exam because you have to be away for a sport competition, please make sure to approach me about the make-up exam in advance **with a note from your coach**.

- The schedule for the final exam is set by the University. I will not schedule an early final exam for whatever reason.

- **I *do not* assign work for extra credit. There are *no* bonus points that you can earn.**

- Once you hand in your final exam, there is nothing more you can do to change your grade.

Grading and Evaluation

I will calculate your grade based on a weighted percentage of your scores as follows:

Homework	20%
Exams (2 midterms, 25% each)	50%
Final exam	30%

Your final grades will be determined as follows:

90% and above	A	82--85%	B+	70--73%	C+	56--60%	D+
86--89%	A-	78--81%	B	66--69%	C	50--55%	D
		74--77%	B-	61--65%	C-	below 50%	F

Please note that I do *not* grade on a curve. Grades will be rounded up. For example, 85.6% will become an 86% (A-), but 85.3% will remain a B+. **A score of 85.5% will be rounded to 85% not 86%.**

Tentative Course Schedule

The tentative course schedule is as follows. This might change and I will try my best to announce any changes beforehand.

Week	Date	Chapter and Topic	Comments
(1)	Sept 5 (T) Sept 6 (W) Sept 8 (F)	(1) Introduction, dot and cross products (1) Triple products, gradient, del operator (1) Divergence, curl, second derivative, Laplacian	HW1
(2)	Sept 11 (M) Sept 12 (T) Sept 13(W) Sept 15 (F)	(1) Integral calculus, examples (1) Spherical polar and cylindrical coordinates (2) Electrostatics, Coulomb's law (2) Electric field lines, flux, Gauss's law	HW2
(3)	Sept 18 (M) Sept 19 (T) Sept 20 (W) Sept 22 (F)	(2) More on Gauss's Law, div **E**, curl **E** (2) Electric potential (2) Finding potentials (2) Work and energy	HW3
(4)	Sept 25 (M) Sept 26 (T) Sept 27 (W) Sept 29 (F)	(2) Energy of discrete and continuous charge dist. (2) Conductors, Capacitance (2) Boundary Conditions (3) Laplace's equation in 1D	HW4
(5)	Oct 2 (M) Oct 3 (T) Oct 4 (W) Oct 6 (F)	**Exam Review** (3) Separation of variables (Cartesian) (3) Separation of variables (Spherical) (3) Legendre Polynomials (cont.)	**Exam 1, 6:00 – 8:00 pm** HW5

(6)	Oct 9 (M) Oct 10 (T) Oct 11 (W) Oct 13 (F)	(3) Multipole expansion, dipole moment (3) More on multipoles (3) Examples (4) Atomic polarizability	HW6
(7)	Oct 16 (M) Oct 17 (T) Oct 18 (W) Oct 20 (F)	(4) Polarization, bound charges (4) Bound and free charges, electric displacement (4) Dielectric constant (4) Capacitors	HW7
(8)	Oct 23 (M) Oct 24 (T) Oct 25 (W) Oct 27 (F)	(4) Torque on dipoles, Force on dipoles and dielectrics (4) Chapter 4 examples (5) Lorentz force, currents, continuity equation (5) Biot-Savart law, parallel wires	HW8
(9)	Oct 30 (M) Oct 31 (T) Nov 1 (W) Nov 3 (F)	(5) Examples (5) Ampere's law, div **B**, infinite wire, plane, solenoid (5) Toroid, moving planes, magnetic vector potential (5) Magnetic vector potential, boundary conditions	HW9
(10)	Nov 6 (M) Nov 7 (T) Nov 8 (W) Nov 10 (F)	(5) Magnetic vector potential, boundary conditions (5) Examples (5) Multipole expansion, dipole potential and field (5) Dipole Field and examples	HW10
(11)	Nov 13 (M) Nov 14 (T) Nov 15 (W) Nov 17 (F)	**Exam Review** (6) Torques and forces on magnetic dipoles (6) Atomic interaction, magnetization, bound currents (6) Ampere's law, auxiliary field **H**	**Exam 2, 6:00 – 8:00 pm** HW11
(12)	Nov 20 (M)	(6) Linear media I	

	Nov 21 (T) Nov 22 (W) Nov 24 (F)	(6) Linear media II, ferromagnetism (7) Ohm's law **NO CLASS**	**THANKSGIVING BREAK**
(13)	Nov 27 (M) Nov 28 (T) Nov 29 (W) Dec 1 (F)	(7) Motional emf (7) Faraday's law I (7) Faraday's law II (7) Faraday's law III	HW12
(14)	Dec 4 (M) Dec 5 (T) Dec 6 (W) Dec 8 (F)	(7) Faraday's law IV (7) Inductance (7) Energy in inductors, *LC* circuits (7) Maxwell's equations	HW13
(15)	Dec 11 (M) Dec 12 (T) Dec 13 (W) Dec 15 (F)	(7) Maxwell's equations inside matter (9) 1D waves, polarization (9) Electromagnetic waves (9) Electromagnetic waves	HW14
(16)		**Final Exam: Tuesday, December 19** **2:45 – 4:45 pm, A109**	