PHYS 346 – Electricity & Magnetism II
Spring 2013

Meeting Time: **Lecture** MWF 7:50 - 8:40 am **Lab** W 1:15 – 4:15 pm
Classroom: CHS 108
Instructor: Dr. Paul A. Belony, Jr.
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Office Hours: **M,W,F**: 10:30AM-12PM (Other hours by appointment)

Required Course Materials

- ✓ ***Introduction to Electrodynamics***, *3rd ed., David J. Griffiths.*

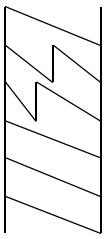
Course Description

This course, Physics 346, aims to provide students with a working knowledge of the concepts of magnetostatics, electrodynamics, electromagnetic waves, and wave theory; this course will focus on preparing students for graduate school or industry. Students will be introduced to vector potential properties and will be able to determine the magnetic field configuration for a variety of current distributions. Maxwell's equations will be thoroughly applied to solve numerous problems. At times, some graduate qualifier-level problems will be used as in-class examples to offer an early shower of what to expect in graduate school. Students will be presented with in-class demonstrations engaging them in active learning. The course contains a laboratory portion in which students will gain experience using a variety of equipment for conducting physical measurements.

The areas of content are Magnetic field interactions and properties, Vector Potential A, Ampere's Circuital Law, Faraday's Law of Induction, Energy, Torque, Magnetic Pressure, EM Waves, and Electric Dipole Retardation.

Grading Policy

Grade	Percentage Equivalents
A	90 – 100
B	80 – 89
C	70 – 79
D	60 – 69
F	59 or lower



Assessment:	%Weight
Homework Problems	20
Labs	20
Project	20
Quizzes	20
Final Exam	20

Homework Problems:
The aforementioned problem sets constitute a significant portion of your grade. Your work on these problem sets, as well as on lab reports and your paper, is subject to the Moravian College Policy on Academic Honesty. Refer to the Student Handbook or ask your instructor if you have any doubts or questions about any submitted work.

Due dates and late policy: Students are expected to submit their work by the due date. Work submitted after the due date will receive a zero.

Attendance Policy:
Students are expected to class. I will take attendance and will reserve the right to lower your grades accordingly should more than two unexcused absences accrue during the semester.

Project/Paper and Presentation:
To augment your overall learning experience and provide an experimental aspect to the course, you will be required to present a project during the term. Students will be researching a topic in physics and will write a formal research paper. This assignment includes: selecting a topic, producing a preliminary and final annotated bibliography, rough drafts, and writing the final draft of the paper. Students will also give a 15-20 minute presentation the last week of class. You have the opportunity to select and work on a project of your choice. You MUST discuss your project choice with me before you get it started.

The following are some suggestions for possible projects:

1. A theoretical examination of a non-trivial distribution of charges, with the calculation of equipotential lines (or surfaces) and electric lines created by such a distribution. {This one may be done analytically or numerically using a computer.}
2. Write a review paper {at least 4 pages in length} on a current topic in E&M.
3. Review and present an appropriate Physics article to the class. {The topic should be related to the application of E&M}.
4. Develop, construct, and run an experiment to be used by future students.

"The Writing Center is located in a building that is not accessible to persons with mobility impairments. If you need services of the Writing Center, please call 610-861-1392

Quizzes & Final Exams:
There will be at least four (in-lab) ten-minute quizzes during the semester. There will also be a final comprehensive exam. Makeup will not be given for the exams, and you cannot take an exam early or late.

Lab

This course has a laboratory component. To instill good laboratory report skills, lab reports will be submitted throughout the semester according to a prescribed format that follows the style of popular physics journals. Students will also have the opportunity to peer review each other's work. I will brief the class on the weekly lab that you will perform. Moreover, I will use the lab period to give quizzes and also solve problems.

Disability:

Students who wish to request accommodations in this class for a disability should contact Elaine Mara, assistant director of learning services for academic and disability support at 1307 Main Street, or by calling 610-861-1510. Accommodations cannot be provided until authorization is received from the Academic Support Center.

Subject to Revision

	Date	Topic	Lab
M	Jan. 14	Force on a moving charge	**No Lab**
W	Jan. 16	Chapter 5 (reading assignments)	
F	Jan. 18	Chapter 5 (reading assignments)	
M	Jan. 21	*No Class (Martin Luther-King's Birthday)*	**Lab#1 – Current Balance**
W	Jan. 23	Biot-Savart Law, B on axis of current loop, force between wires, properties of B field, flux, Hall effect	
F	Jan. 25	Ampere's Law	
M	Jan. 28	Examples: solenoid, current sheets, toroid; Magnetostatics vs Electrostatics	**Lab#1 – Current Balance**
W	Jan. 30	Properties of A field, examples on A and B fields: wire, solenoid, toroid	
F	Feb. 01	Multiple expansion of A, magnetic dipole	
M	Feb. 04	Faraday's law of induction, Lenz's law, expanding loop example	**Lab#2 – Maxwell-Helmholtz Pair**
W	Feb. 06	More on Faraday's law, examples, Mutual inductance	
F	Feb. 08	Self inductance, LR circuit example, coupling coefficient, energy stored in B field	
M	Feb. 11	More on magnetic energy	**Lab#3 – Faraday's law and lnduction**
W	Feb. 13	Torque on a current carrying wire in B field, magnetic pressure, eddy currents, skin effect	
F	Feb. 15	Magnetic materials, magnetization vector M, equivalent currents, field equations, H vector,	
M	Feb. 18	Magnetic susceptibility and permeability, hysteresis and Rowland's ring experiment	**Lab#4 – lnductors, Goils and Transformers**
W	Feb. 20	Boundary conditions on H, idealized bar magnet	

F	Feb. 22	Magnetic circuits	
M	Feb. 25	Maxwell's equations, conservation of charge, displacement current	**Lab#5 – Hysteresis + MOKE**
W	Feb. 27	Complex notation, solution for plane attenuated waves, the Poynting vector	
F	Mar. 01	Poynting vector, plane EM waves in free space	
M	Mar. 04	*Spring Recess*	**Spring Break – no lab**
W	Mar. 06	*Spring Recess*	
F	Mar. 08	*Spring Recess*	
M	Mar. 11	Energy density of free space plane waves	**Lab#6 – Magnetic Susceptibility**
W	Mar. 13	Plane EM waves in LIH media	
F	Mar. 15	Application of plane wave results to non-conductor	
M	Mar. 18	Application of plane wave results to conductor, skin depth	**Lab#7 – Magnetic Braking and Eddy Damping**
W	Mar. 20	Plane EM waves in a plasma, phase and group velocity (demo)	
F	Mar. 22	Group and phase velocity, dispersion relations	
M	Mar. 25	Intensity, more on Maxwell's equations, retarded potential, examples: electric and magnetic dipole	**Lab#8 – Faraday Effect**
W	Mar. 27	*Easter Recess*	
F	Mar. 29	*Easter Recess*	
M	Apr. 01	*Easter Recess*	**Lab#8 – Faraday Effect**
W	Apr. 03	The Lorentz condition, leaky spherical capacitor	
F	Apr. 05	Radiation by an accelerated charge	
M	Apr. 08	Electric Dipole Radiation.	**Lab#19– Fresnel Equations**
W	Apr. 10	Field lines of dipole radiation and Electric dipole antenna	
F	Apr. 12	Antenna arrays and magnetic dipole	
M	Apr. 15	Magnetic Dipole Radiation, TEM Waves and Waveguides (chapter 34)	**Lab#10 – Vibrating Sample Magnetometer**
W	Apr. 17	TE, TM, and TEM wave theory	
F	Apr. 19	Rectangular wave guide	
M	Apr. 22	Reflection and refraction	**Lab# – Project Presentation**
W	Apr. 24	Fresnel's equations	
F	Apr. 26	Semester Review	