PHYS 0302 **Electromagnetic Theory & Waves** **Winter 2018**
CRN: 11476

Course Meetings:	Class Meetings: Tu, F: 10:30 AM – 12:30 PM Tutorial Sections: M, Th: 1:30 – 4 PM (30 min each) MBH 538
Instructor:	Professor Paul Hess, MBH 528 Office Phone: x5860 phess@middlebury.edu Pronouns: He, Him, His
Office Hours:	Mon: 8:30 – 10:30, Wed: 2 – 4 , Thurs: 9:15 – 10:45, by appointment, or **any time my door is open.**
Course Communication:	I will send important course updates throughout the semester via **e-mail**, so please check your inbox regularly. I will respond to e-mails sent before **5 PM** by the end of the day.
Course Website:	go/phys302 The course website is hosted by Canvas and will be used to distribute and submit assignments for the course.
Required Texts:	Griffiths, David. *Introduction to Electrodynamics – 4th Edition*. Pearson Education, 2013.
Course Description:	Maxwell's theory of the electromagnetic field provides the basis of our understanding of the nature of light, radio waves, infrared radiation, X-rays, and other forms of electromagnetic radiation. This course examines the behavior of electromagnetic waves starting from Maxwell's equations, the fundamental laws of electromagnetism. Topics include wave propagation in different materials; reflection and refraction at interfaces; applications in space communications, optics, and other fields; and relativistic electrodynamics.
Course Goals:	Students will: • Apply their knowledge of Maxwell's equations to develop the deep mathematical framework underpinning much of what they have already learned about light and optics in other physics courses. • Communicate this understanding through presentations and discussions of problem solutions to an audience of their professor and a peer. • Craft detailed written solutions to the assigned problems that they would be proud to publish in a future version of *Griffiths*.

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Course Policies and Expectations:

Course Structure:

The course will be structured somewhat differently from other advanced physics course you have taken. The course will be divided into class meeting and tutorial sections. The class meetings will allow the whole class to have a common starting point to approach the problems, review necessary material, outline difficult mathematical concepts, and make connections to real-world applications and physics research. Classes will involve active participation in the form of poll questions, discussions, and "warm-up questions" for problem solving.

As in most of your physics classes, the bulk of your learning will come outside of class in the form of problem set solutions. In PHYS 0302, extra emphasis will be placed on presentations and discussions of these solutions with myself and a partner. The written problem solutions will be submitted the day following the tutorial discussions.

These components are timed in the following way:

1. Class Meeting (Tu, Fri Mornings)
2. Tutorial Meetings 2-3 days later (Th, Mon Afternoons)
3. Written Problem Solutions due before next class meeting

Reading Assignments:

See the course schedule for reading assignments from *Griffiths*. Doing the reading before class meetings will be ***absolutely essential*****.**

Tutorial Meetings:

At the tutorial meetings I will ask each student to present on the blackboard some of the week's assigned homework problems. You will be encouraged to expand upon your solution, describing the implications of your result. It is therefore critical that you come to the tutorial meeting with the problem set close to completion. As a rough guide, you should be putting in more than 80% of your problem set effort before the tutorial meeting, saving the time to put some final polish on your written solutions.

Attendance and Participation:

Tutorial meetings are ***required***, and must be rescheduled with me and your partner if there are extenuating circumstances that require you to miss one. You must be in touch with me at least ***3 days in advance*** of the absence so we can find a time to reschedule the meeting.

Late Work Policy:

Assignments turned in after the deadline ***will not be accepted***. I will grant exceptions for family emergencies or other extenuating personal circumstances, but you must obtain approval prior to the assignment's deadline.

Tutorial Partners: Tutorial partners will work collaboratively during the tutorial presentations, although one student will take the lead for each problem. Being a respectful partner means giving your partner a chance to talking without interrupting during tutorial sessions.

Technology Policy: Laptops and tablets should be used only for notetaking, and cell phones must remain put away during class. Be respectful of your classmates by not distracting them with your devices.

Assignments and Evaluations

Homework Assignments: There will be two homework assignments per week. These problem sets should be written up using well formatted and legible equations, explanatory sentences, and diagrams when appropriate.

Submitting Homework: Homework will be submitted by **10:00 AM** on Tu & F. Your homework should be scanned and submitted on the course website. Typed solutions are also acceptable (and encouraged).

Solutions: Solutions will be posted in a binder in MBH 525.

Tutorial Expectations: Your grade for the tutorial meetings with be based largely on preparedness. A *fully prepared* student will have done most of the problem set correctly. They will have made the correct assumptions or approximations to get started on those they could not complete. They may have extended beyond what was asked in the problem or connected the topics to their other courses. A *partially prepared* student may not have finished a significant number of the problems, but has a good ideas as to how to make progress. An even *less prepared* student may have attempted several of the problems, but the tutorial session is largely used for help getting started. It is not acceptable to show up *completely unprepared*, having not worked any of the problems in advance of the tutorial meeting.

Exams: There will be two exams, on **January 19** and **February 2**.

Grade: Grades will be determined by the following weighting of all the course assignments.

Written Problem Set Solutions	30%
Tutorial Meetings	20%
Class Participation and “Warmup Questions”	10%
Midterm Assessment	15%
Final Assessment	25%

Academic Policies

Guidelines for Collaboration:

One of the goals of this course is to enhance your ability to discuss complex scientific ideas with other scientists. To that end, you are encouraged to discuss the topics from class and homework problems with classmates and your tutorial partner. You are encouraged to work problems collaboratively on the blackboard provided you are an ***active*** participant in the process. However, all assignments that you turn in must reflect you own work. It is a good idea to work problems on your own first before beginning a collaboration.

Specific Guidelines:
Homework: After you have discussed homework problems with classmates, you must work independently to write up these problems ***in your own words***. It is your responsibility to make a note of which classmates you worked with on each homework assignment you submit.

Exams: Unlike the homework you cannot work, collaborate, or discuss with your peers. You will be restricted to using written sources (book, notes, etc.) as specified on the exam.

Academic Dishonesty:

Please see the Honor Code (go/honorcode) for complete guidelines. If you have any questions regarding academic dishonesty or proper citation of work, don't hesitate to ask. It's much better to request an extension rather than take a 'short-cut' and copy someone else's work. The penalties for doing the latter are severe, and they can impact your future far beyond the boundaries of this course.

Special Considerations:

Students with documented disabilities who believe that they may need accommodations in this class are encouraged to contact me **as early in the semester as possible** to ensure that such accommodations are implemented in a timely fashion. Assistance is available to eligible students through Student Accessibility Services. Please contact one of the ADA coordinators. Jodi Litchfield can be reached at *litchfie@middlebury.edu* or 802-443-5936, and Courtney Cioffredi can be reached at *ccioffredi@middlebury.edu* or 802-442-2169 for more information. All discussions will remain confidential.

PHYS 0302 - WINTER TERM, 2018

WK	M	T	W	TH	F
1	1/8 **Classes Begin** **Class: 2 PM – 4 PM** Reading: Griffiths 7.3 Topics: Review Maxwell's Equations in many forms PS #1 Assigned (Review)	1/9 **Class: 10:30 AM – 12:30 PM** Reading: Griffiths Chapter 8 Topics: Conservation Laws PS #1 Due PS #2 Assigned	1/10	1/11 **Tutorial: 1 PM – 4:30 PM**	1/12 **Class: 10:30 AM – 12:30 PM** Reading: Griffiths 9.1-9.3 Topics: Wave Eqn., EM Waves, Reflection/Diffraction PS #2 Due PS #3 Assigned
2	1/15 **Tutorial: 1 PM – 4:30 PM** Martin Luther King Day	1/16 **Class: 10:30 AM – 12:30 PM** Reading: Griffiths 9.4-9.5 Topics: Absorption & Dispersion, Waveguides PS #3 Due PS #4 Assigned	1/17	1/18 **Tutorial: 1 PM – 4:30 PM**	1/19 **Class: 10:30 AM – 12:30 PM** Reading: Griffiths 10.1-10.2 Topics: Vector and Scalar Potentials, Retarded Potential **Midterm Exam (2-5 PM)** PS #4 Due PS #5 Assigned
3	1/22 **Tutorial: 1 PM – 4:30 PM**	1/23 **Class: 10:30 AM – 12:30 PM** Reading: Griffiths 10.3, 11.1 Topics: Potentials of Moving Charges, Radiation Overview PS #5 Due PS #6 Assigned	1/24	1/25 **Tutorial: 1 PM – 4:30 PM**	1/26 **Class: 10:30 AM – 12:30 PM** Reading: Griffiths 11.2 Topics: Radiation from Point Charges PS #6 Due PS #7 Assigned
4	1/29 **Tutorial: 1 PM – 4:30 PM**	1/30 **Class: 10:30 AM – 12:30 PM** Reading: Griffiths 12.3 (Skim 12.1-12.2 for review) Topics: Relativistic EM Fields PS #7 Due PS #8 Assigned	1/31	2/1 **Tutorial: 1 PM – 4:30 PM**	2/2 **Final Exam** 6 hour take home PS #8 Due **Classes End 4:15**