



## **PHYS 532.01W Electricity and Magnetism for Educators**

COURSE SYLLABUS: Spring 2020

### **INSTRUCTOR INFORMATION**

**Instructor:** Dr. Robynne Lock

**Office Location:** STC 238

**Office Hours:** TBA

**Office Phone:** 903-468-8767

**Office Fax:** 903-886-5480

**University Email Address:** [robynne.lock@tamuc.edu](mailto:robynne.lock@tamuc.edu)

**Preferred Form of Communication:** Email

**Communication Response Time:** 48 hours

### **COURSE INFORMATION**

#### **Materials – Textbooks, Readings, Supplementary Readings**

**Textbooks** – Fleisch, A Student's Guide to Maxwell's Equations (ISBN: 9780521701471)

**Recommended book** – Tallarida, Pocket book of Integrals and Mathematical Formulas, 4th edition (2008) (ISBN-13: 978-1420063042)

This book is a useful reference containing trigonometric identities, integral tables, etc. You may use it on exams.

Griffiths, Introduction to Electrodynamics (any edition) or similar intro E&M textbook

**Readings** – A list of readings is included at the end of the syllabus.

### **Course Description**

This course covers electromagnetism from a variety of perspectives. While the course will include traditional advanced electricity and magnetism content, history of electromagnetism, current events in physics, and physics education research relevant to electricity and magnetism will be discussed.

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Note that the traditional advanced E&M content requires calculus, including multivariable calculus. Review resources will be provided at the beginning of the semester. The first two weeks of class will include review of vector calculus.

## **University Catalog Description**

Topics include vector analysis, electrostatics, electric fields, magnetostatics, magnetic fields, and electrodynamics. Connections to modern applications will be explored. Emphasis will be placed on conceptual understanding.

## **Student Learning Outcomes**

1. Students will be able to analyze the divergence and curl of electric and magnetic fields.
2. Students will be able to apply Coulomb's Law and Gauss's Law.
3. Students will be able to apply the Biot-Savart Law and Ampere's Law.
4. Students will be able to discuss the application of findings of physics education research to their own classrooms.
5. Students will be able to incorporate history and current events in physics into their own teaching.

## **COURSE REQUIREMENTS**

### **Minimal Technical Skills Needed**

Students should be able to use myLeo Online, view videos on YouTube, and use scanners and pdf combiners.

### **Instructional Methods**

Each electricity and magnetism content module contains 1-3 videos. Students should plan to watch ~1 video per week. There will be points during each video during which you should pause and work the sample problems before continuing to watch the video. A discussion board can be found in each electricity and magnetism module for you to discuss working problems with fellow students, including both the "in-class" problems for the videos and your homework problems. Each reading assignment will be accompanied by a document introducing the paper and containing prompts for your reading reflection. There will also be a discussion board for each reading assignment. You will have an assignment due approximately every week, either a problem set, a reading reflection, or an exam. See the schedule at the end of the syllabus. There will be 1 midterm and a final covering the electricity and magnetism content. The final is not cumulative.

### **Student Responsibilities or Tips for Success in the Course**

Students are expected to watch the videos, participate in all discussions, complete all homework assignments, and complete all exams. Students are to be aware of all deadlines and ask questions when directions are unclear.

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## GRADING

Final grades in this course will be based on the following scale:

Grading scale:

90 points < A  
80 points < B < 89 points  
70 points < C < 79 points  
60 points < D < 69 points  
F < 60 points

## Assessments

Grades will be based on 5 components:

40% Exams  
15% Problem set homework  
20% Reading reflection homework  
5% Problem discussion  
20% Reading discussion

## Assessments

**Exams:** There will be 1 midterm and a final. They will be weighted equally, so each exam is worth 20% of your overall grade. See exam due dates at the end of the syllabus. The exams will be made available one week before the due date. The exams have a 3.5 hour time limit. It is your responsibility to set aside a time when you can complete the exam and follow the time limit. Exams will be open book, but I recommend using a crib sheet for quick reference. You may also use the pocket book of integrals or similar printouts from the internet of integral tables, the unit circle, and series tables. Suggestions for such references are available upon request. You will complete exams on your own paper and then scan them and submit them to myLeo Online as a single pdf document with the pages in order and properly oriented.

**Problem set homework:** Five problem sets will be assigned. See the schedule at the end of the syllabus. Problem sets will be made available no later than one week before the due date. Assignments will be graded 50% for effort and 50% for correctness. For example, if you fully attempted each problem but every answer was incorrect, you would receive a grade of 50. You will complete problem sets on your own paper and then scan them and submit them to myLeo Online as a single pdf document with the pages in order and properly oriented. Problem Sets should be submitted as a single file. Do NOT upload several jpg files. You are strongly encouraged to discuss your problem set

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homework with fellow classmates on the class discussion boards. Problem set solutions will be made available after the deadline.

Reading reflection homework: Six reading assignments will be assigned. See the schedule at the end of the syllabus. Each reading assignment will be an article about history, current events, or physics education research. You will write a reading reflection based on the assigned prompts. A document will be made available containing the rubric for how reading reflection homework will be graded. You should submit your reading reflection as either a Word document or a pdf document through myLeo Online.

Problem discussion: You are expected to participate in the problem discussions to discuss the sample problems and to discuss the problem set homework. A document called Problem Discussion Rubric will be made available so that you understand how you will be graded for your participation in these discussions. You must make your first post in the problem discussion forum no later than the Monday listed as the due date in myLeo Online at noon, but additional posts can be made later. See myLeo Online for all dates.

Reading discussion: You are expected to participate in discussions about the reading assignments. A document called Reading Discussion Rubric will be made available so that you understand how you will be graded for your participation in these discussions. Reading discussions will open on the Wednesdays when reading reflection homeworks are due and will close on the following Wednesday. You must make your first post in the reading discussion forum no later than the Monday listed as the due date in myLeo Online at noon, but additional posts can be made later. You must write at least three posts total. At least two of these posts should be responses to other students' posts.

## **TECHNOLOGY REQUIREMENTS**

### **Browser support**

D2L is committed to performing key application testing when new browser versions are released. New and updated functionality is also tested against the latest version of supported browsers. However, due to the frequency of some browser releases, D2L cannot guarantee that each browser version will perform as expected. If you encounter any issues with any of the browser versions listed in the tables below, contact D2L Support, who will determine the best course of action for resolution. Reported issues are prioritized by supported browsers and then maintenance browsers.

Supported browsers are the latest or most recent browser versions that are tested against new versions of D2L products. Customers can report problems and receive support for issues. For an optimal experience, D2L recommends using supported browsers with D2L products.

Maintenance browsers are older browser versions that are not tested extensively against new versions of D2L products. Customers can still report problems and receive

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support for critical issues; however, D2L does not guarantee all issues will be addressed. A maintenance browser becomes officially unsupported after one year.

Note the following:

- Ensure that your browser has JavaScript and Cookies enabled.
- For desktop systems, you must have Adobe Flash Player 10.1 or greater.
- The Brightspace Support features are now optimized for production environments when using the Google Chrome browser, Apple Safari browser, Microsoft Edge browser, Microsoft Internet Explorer browser, and Mozilla Firefox browsers.

### Desktop Support

Browser	Supported Browser Version(s)	Maintenance Browser Version(s)
Microsoft® Edge	Latest	N/A
Microsoft® Internet Explorer®	N/A	11
Mozilla® Firefox®	Latest, ESR	N/A
Google® Chrome™	Latest	N/A
Apple® Safari®	Latest	N/A

### Tablet and Mobile Support

Device	Operating System	Browser	Supported Browser Version(s)
Android™	Android 4.4+	Chrome	Latest
Apple	iOS®	Safari, Chrome	The current major version of iOS (the latest minor or <b>point</b> release of that major version) and the previous major version of iOS (the latest minor or <b>point</b> release of that major version). For example, as of June 7, 2017, D2L supports iOS 10.3.2 and iOS 9.3.5, but not iOS 10.2.1, 9.0.2, or any other

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Device	Operating System	Browser	Supported Browser Version(s)
			version. Chrome: Latest version for the iOS browser.
Windows	Windows 10	Edge, Chrome, Firefox	Latest of all browsers, and Firefox ESR.

- You will need regular access to a computer with a broadband Internet connection. The minimum computer requirements are:
  - 512 MB of RAM, 1 GB or more preferred
  - Broadband connection required courses are heavily video intensive
  - Video display capable of high-color 16-bit display 1024 x 768 or higher resolution
- You must have a:
  - Sound card, which is usually integrated into your desktop or laptop computer
  - Speakers or headphones.
  - \*For courses utilizing video-conferencing tools and/or an online proctoring solution, a webcam and microphone are required.
- Both versions of Java (32 bit and 64 bit) must be installed and up to date on your machine. At a minimum Java 7, update 51, is required to support the learning management system. The most current version of Java can be downloaded at: [JAVA web site http://www.java.com/en/download/manual.jsp](http://www.java.com/en/download/manual.jsp)
- Current anti-virus software must be installed and kept up to date.

Running the browser check will ensure your internet browser is supported.

Pop-ups are allowed.

JavaScript is enabled.

Cookies are enabled.

- You will need some additional free software (plug-ins) for enhanced web browsing. Ensure that you download the free versions of the following software:
  - [Adobe Reader https://get.adobe.com/reader/](https://get.adobe.com/reader/)
  - [Adobe Flash Player \(version 17 or later\) https://get.adobe.com/flashplayer/](https://get.adobe.com/flashplayer/)
  - [Adobe Shockwave Player https://get.adobe.com/shockwave/](https://get.adobe.com/shockwave/)
  - [Apple Quick Time http://www.apple.com/quicktime/download/](http://www.apple.com/quicktime/download/)

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- At a minimum, you must have Microsoft Office 2013, 2010, 2007 or Open Office. Microsoft Office is the standard office productivity software utilized by faculty, students, and staff. Microsoft Word is the standard word processing software, Microsoft Excel is the standard spreadsheet software, and Microsoft PowerPoint is the standard presentation software. Copying and pasting, along with attaching/uploading documents for assignment submission, will also be required. If you do not have Microsoft Office, you can check with the bookstore to see if they have any student copies.

## ACCESS AND NAVIGATION

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or [helpdesk@tamuc.edu](mailto:helpdesk@tamuc.edu).

**Note:** Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include the availability of a backup PC at home or work, the temporary use of a computer at a friend's home, the local library, office service companies, Starbucks, a TAMUC campus open computer lab, etc.

## COMMUNICATION AND SUPPORT

### Brightspace Support

#### Need Help?

#### Student Support

If you have any questions or are having difficulties with the course material, please contact your Instructor.

### Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778 or click on the **Live Chat** or click on the words “[click here](#)” to submit an issue via email.



### System Maintenance

D2L runs monthly updates during the last week of the month, usually on Wednesday. The system should remain up during this time unless otherwise specified in an announcement. You may experience minimal impacts to performance and/or look and feel of the environment.

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## **Interaction with Instructor Statement**

The best method to reach the instructor is through email. You can send an email to robynne.lock@tamuc.edu with **PHYS 532 in the subject line**. If you do not receive a response within 48 hours, send a reminder email.

## **COURSE AND UNIVERSITY PROCEDURES/POLICIES**

### **Course Specific Procedures/Policies**

1. You are responsible for knowing when all deadlines are.
2. You are responsible for asking for clarification whenever directions are unclear to you.
3. **When emailing the instructor, include the course number in the subject line.**
4. You are expected to check your email and myLeo Online for class announcements at least once per day. Emails will be sent to the email addresses you provided to MyLeo.
5. Homework and exams are due by 11:30 pm on the specified due dates. Late homework will be accepted up to a week late at 50% off. Late exams will not be accepted except in extenuating circumstances.
6. Assignments are to be submitted as a single pdf file. All images must be oriented correctly. I should be able to grade your assignment on screen with no issues. You are responsible for checking that your document is high enough resolution and legible.
7. Students are expected to be professional and respectful.

### **Syllabus Change Policy**

The syllabus is a guide. Circumstances and events, such as student progress, may make it necessary for the instructor to modify the syllabus during the semester. Any changes made to the syllabus will be announced in advance.

## **University Specific Procedures**

### **Student Conduct**

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail in the [Student Guidebook](http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/studentGuidebook.aspx).  
<http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/studentGuidebook.aspx>

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## **TAMUC Attendance**

For more information about the attendance policy please visit the [Attendance](#) webpage and [Procedure 13.99.99.R0.01](#).

<http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx>

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/academic/13.99.99.R0.01.pdf>

## **Academic Integrity**

Students at Texas A&M University-Commerce are expected to maintain high standards of integrity and honesty in all of their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

[Undergraduate Academic Dishonesty 13.99.99.R0.03](#)

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/undergraduates/13.99.99.R0.03UndergraduateAcademicDishonesty.pdf>

[Graduate Student Academic Dishonesty 13.99.99.R0.10](#)

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/graduate/13.99.99.R0.10GraduateStudentAcademicDishonesty.pdf>

## **Plagiarism**

Plagiarism is a criminal activity. You must cite all sources of information. Unreferenced copying of material, whether parts of sentences, whole sentences, paragraphs, or entire articles can result in a score of zero for your assignment and may result in further disciplinary action.

## **ADA Statement**

### **Students with Disabilities**

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

### **Office of Student Disability Resources and Services**

Texas A&M University-Commerce

Gee Library- Room 162

Phone (903) 886-5150 or (903) 886-5835

Fax (903) 468-8148

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Email: [studentdisabilityservices@tamuc.edu](mailto:studentdisabilityservices@tamuc.edu)

Website: [Office of Student Disability Resources and Services](#)

<http://www.tamuc.edu/campusLife/campusServices/studentDisabilityResourcesAndServices/>

### **Nondiscrimination Notice**

Texas A&M University-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

### **Campus Concealed Carry Statement**

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in Texas A&M University-Commerce buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and A&M-Commerce Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations.

For a list of locations, please refer to the [Carrying Concealed Handguns On Campus](#) document and/or consult your event organizer.

Web url:

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/34SafetyOfEmployeesAndStudents/34.06.02.R1.pdf>

Pursuant to PC 46.035, the open carrying of handguns is prohibited on all A&M-Commerce campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.

### **Resources for Students**

Life can be hard. I understand that you have a life beyond this class. I am here to support you as best I can, but there are many offices on campus that can help you.

#### **Mental health issues**

Counseling is available to all students for free.

Call or drop by in-person to make an appointment  
Halladay Student Serv. #204  
903-886-5145

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## **Student conduct issues**

If you believe a student has violated the code of conduct, you can report it here:



<https://bit.ly/33WRMOK>

Violations of the code of conduct include altercations, disorderly conduct, disruptive activity, discrimination, and sexual harassment.

## **Student of concern/distress**

If there is a student you are concerned about for reasons such as threatening behavior, talk of suicide, or homelessness, you can report those concerns using the CARE Report Form:



<https://bit.ly/35VC5cf>

## **Concerns about the university**

You can report any concerns you have about the university to:

StudentConcern@tamuc.edu

The Student Concern form is available at: <https://bit.ly/33Qv1f9>

## **Title IX: Sexual harassment and assault**

If you have experienced or are aware of sexual harassment, sexual misconduct, domestic violence, dating violence, or stalking, you can report this to the Title IX office.

TitleIX@tamuc.edu

McDowell Administration (BA) Building 259

903-468-3104

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the additional resources here:

Crisis center of NorthEast Texas: <http://www.ccnetx.org>

Know your IX: <http://knowyourix.org>

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End rape on campus: <http://endrapeoncampus.org>  
Clery Center for Security on Campus: <http://clerycenter.org>  
Not Alone: <https://www.notalone.gov>

### **Don't know where to go?**

If you need help and you do not know where to go, Campus Life and Student Development can direct you to the most relevant office.

Campuslife@tamuc.edu  
Halladay 201  
903-886-5195

## **COURSE OUTLINE / CALENDAR**

### Advanced Electricity and Magnetism Content Schedule

Weeks are labeled by the Monday of each week. E&M content videos will be uploaded by Wednesday at noon of each week.

1/30 Week 1: Vector calculus review and application  
2/3 Week 2: Vector calculus review and application  
2/10 Week 3: Electrostatics  
2/17 Week 4: Electrostatics  
2/24 Week 5: Electrostatics  
3/2 Week 6: Magnetostatics  
3/9 Spring Break  
3/16 Week 7: Magnetostatics  
3/23 Week 8: Electrodynamics  
3/30 Week 9: Electrodynamics  
4/6 Week 10: Electrodynamics  
4/13 Week 11: Electromagnetic waves  
4/20 Week 12: Electromagnetic waves  
4/27 Week 13: Electromagnetic waves  
5/4 Final exam week

### Problem Set Homework Deadlines:

Problem sets will be made available at least one week before the due date.

Homework 1: Vector calculus	2/12
Homework 2: Electrostatics	3/4
Homework 3: Magnetostatics	3/25
Homework 4: Electrodynamics	4/15
Homework 5: Electromagnetic waves	4/29

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### Reading Schedule:

Reading reflection homework prompts will be based on the following readings. You will not be required to read all of the articles listed. For many assignments, you will be asked to select a subset of articles from the list.

#### Homework 1: History

- G. Hall, "Maxwell's electromagnetic theory and special relativity," *Phil. Trans. R. Soc. A* 366, 1849 (2008).
- B. Franklin, "Letter XI," In *Benjamin Franklin's experiments and observations on electricity* (pp. 265-266), Cambridge, MA: Harvard University Press (1941).
- J.C. Maxwell. "On Faraday's lines of force," In *A dynamical theory of the electromagnetic field* (pp. 157-159). Edinburgh: Scottish Academic Press (1982).

#### Homework 2: Physics Education Research

- T.M. Scaife and A.F. Heckler, "Interference between electric and magnetic concepts in introductory physics," *Phys. Rev. ST – Phys. Ed. Res.* 7, 010104 (2011).
- J.M. Casperson and M.C. Linn, "Using visualizations to teach electrostatics," *American Journal of Physics* 74, 316 (2006).

#### Homework 3: Current events and real-world applications

- J. Zavisa "How Van de Graaff Generators Work" 1 April 2000. HowStuffWorks.com. <<http://science.howstuffworks.com/transport/engines-equipment/vdg.htm>> 13 January 2016.
- M. Schirber, "Focus: Electrons not the cause of charged grains," *Physics* 7, 58 (2014). DOI 10.1103/Physics.7.58.
- J. Zavisa "How Lightning Works" 1 April 2000. HowStuffWorks.com. <<http://science.howstuffworks.com/nature/natural-disasters/lightning.htm>> 13 January 2016.
- "Static Electricity-Lesson 4-Electric Fields: Lightning," thePhysicsClassroom.com. <<http://www.physicsclassroom.com/class/estatics/Lesson-4/Lightning>> 13 January 2016.
- P. Ball, "Focus: First spectrum of ball lightning," *Physics* 7, 5 (2014). DOI 10.1103/Physics.7.5.
- D. Voss, "Synopsis: A crackling in the air," 2 May 2013. Physics.aps.org. <<https://physics.aps.org/synopsis-for/10.1103/PhysRevLett.110.185005>> 13 January 2016.

#### Homework 4: Current events

- J. Morgan, "Elusive magnetic 'monopole' seen in quantum system," 30 January 2014. BBC.com. <<http://www.bbc.com/news/science-environment-25946734>> 13 January 2014.
- E. Cartlidge, "Magnetic monopoles seen in the lab," 30 January 2014. Physicsworld.com <<http://physicsworld.com/cws/article/news/2014/jan/30/magnetic-monopoles-seen-in-the-lab>> 13 January 2014.

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E. Gibney, "Quantum cloud simulates magnetic monopole," 29 January 2014. Nature News. <<http://www.nature.com/news/quantum-cloud-simulates-magnetic-monopole-1.14612>> 13 January 2016.

"Physicists create synthetic magnetic monopole predicted more than 80 years ago," 29 January 2014. Phys.org. <<http://phys.org/news/2014-01-physicists-synthetic-magnetic-monopole-years.html>> 13 January 2016.

A. Geim, "Everyone's magnetism," Physics Today, Sep. 1998, pp. 36-39.

#### Homework 5: Physics Education Research

N.D. Finkelstein, W.K. Adams, C.J. Keller, P.B. Kohl, K.K. Perkins, N.S Podolefsky, and S. Reid, "When learning about the real world is better done virtually: A study of substituting computer simulations for laboratory equipment," PRST-PER 1, 010103 (2005).

#### Homework 6: Physics Education Research

N.S. Podolefsky and N.D. Finkelsetein, "Use of analogy in learning physics: The role of representations," PRST-PER 2, 020101 (2006).

#### Reading Reflection Homework Deadlines:

Reading assignments will be made available at least one week before the due date.

Homework 1	2/5
Homework 2	2/19
Homework 3	2/26
Homework 4	4/1
Homework 5	4/8
Homework 6	4/22

Exam due dates: Exams will be made available 1 week before the deadline.

Midterm	3/18
Final	5/6