



## PHYS 530.01W Physics Mathematical Methods for Educators

COURSE SYLLABUS: Fall 2019

### 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

**Preferred Form of Communication:** Email

**Communication Response Time:** Within 48 hours on weekdays and weekends

### COURSE INFORMATION

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

**Required Textbook** – Felder & Felder, *Mathematical Methods in Engineering and Physics* (2016) (etext ISBN: 978-1-119-04581-6; paperback ISBN: 978-1-118-44960-8)

**Recommended book** – Tallarida, *Pocket book of Integrals and Mathematical Formulas* Any edition will work. This book is a useful reference containing trigonometric identities, integral tables, etc. You may use it on exams.

**Readings** – All papers can be accessed online from the open access journal Physical Review – Physics Education Research (<https://journals.aps.org/prper/>).

Nguyen, “Students’ understanding and application of the area under the curve concept in physics problems,” PRST-PER 7, 010112 (2011).

Van den Eynde, “Translating between graphs and equations: The influence of context, direction of translation, and function type,” Phys. Rev. PER 15, 020113 (2019).

Bing and Redish, “Analyzing problem solving using math in physics: Epistemological framing via warrants,” PRST-PER 5, 020108 (2009).

Karam, “Framing the structural role of mathematics in physics lectures: A case study of electromagnetism,” PRST-PER 10, 010119 (2014).

*The syllabus/schedule are subject to change.*

Klein, "Student understanding of graph slope and area under a curve: A replication study comparing first-year physics and economics students," Phys. Rev. PER 15, 020116 (2019).

Yerushalmi, "Instructors' reasons for choosing problem features in a calculus-based introductory physics course," PRST-PER 6, 020108 (2011).

## **Course Description**

This course covers mathematical techniques needed for advanced physics. Topics covered include series, complex numbers, linear algebra, differential equations, and vector calculus. Additionally, relevant physics education research literature is discussed.

### **University Catalogue Description**

Vectors and curvilinear coordinates, partial differential equations, linear and non-linear systems, matrix algebra, boundary value problems, Fourier transforms, separation of variables, Sturm-Liouville eigenfunction expansion theory, numerical techniques.

**Student Learning Outcomes** (Should be measurable; observable; use action verbs)

1. Students will be able to use complex numbers and linear algebra in physics contexts.
2. Students will be able to apply differential equations to physics problems.
3. Students will be able to use vector calculus in physics problems.
4. Students will be able to discuss the application of findings of physics education research to their own classrooms.

## **COURSE REQUIREMENTS**

### **Minimal Technical Skills Needed**

**Students need to be able to use myLeo Online, scan assignments and include multiple pages as a single document, and video conference.**

### **Instructional Methods**

Each advanced mathematics 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. Two discussion boards can be found in each advanced mathematics module for you to discuss working problems with fellow students. One discussion board is for the "in-class" problems for the videos, and one discussion board is for your homework. 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 other week alternating between problem sets and reading reflections. See the schedule at the

*The syllabus/schedule are subject to change.*

end of the syllabus. There will be 1 midterm and a final covering the math techniques 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.

### **GRADING**

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

A = 90%-100%

B = 80%-89%

C = 70%-79%

D = 60%-69%

F = 59% or Below

Grades will be based on 5 components:

45% Exams

7.5% Problem set homework

20% Reading reflection homework

7.5% 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 closed book, but you may use a 2-sided 8.5"x11" crib sheet. 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 either scan them or take their picture and submit them to myLeo Online. Submit your crib sheets along with your exams.

**Problem set homework:** Problem sets will be assigned approximately every other week. 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 for effort. You will complete problem sets on your own paper and then either scan them or take their picture and submit them via myLeo Online. Problem Sets should be submitted as a single file. Do NOT upload several jpg files. You are strongly encouraged to discuss

*The syllabus/schedule are subject to change.*

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

Reading reflection homework: Reading assignments will be due approximately every other week. See the schedule at the end of the syllabus. Each reading assignment will be an article from Physical Review – 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. A random subset of reading reflections will be graded.

Problem discussion: You are expected to participate in the problem discussions to discuss the sample problems or 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. Problem discussions will open on Wednesdays and close on Wednesdays. You must make your first post in the problem discussion forum no later than the first Monday at noon.

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

*The syllabus/schedule are subject to change.*

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 version.

*The syllabus/schedule are subject to change.*

Device	Operating System	Browser	Supported Browser Version(s)
			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/)

*The syllabus/schedule are subject to change.*

- 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.

*The syllabus/schedule are subject to change.*

## 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 530 in the subject line**. If you do not receive a response within 48 hours, send a reminder email.

The instructor will hold office hours on Zoom. The URL will be posted in myLeo Online.

The instructor will participate on class discussion boards. Please restrict these discussion boards to their labeled topics.

## 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 11:59 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. Students are expected to be professional and respectful and follow netiquette.

### 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>

*The syllabus/schedule are subject to change.*



Students should also consult the Rules of Netiquette for more information regarding how to interact with students in an online forum: [Netiquette](http://www.albion.com/netiquette/corerules.html)  
<http://www.albion.com/netiquette/corerules.html>

### **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

*The syllabus/schedule are subject to change.*

Gee Library- Room 162

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

Fax (903) 468-8148

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.

### **Harassment Policy**

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 appropriate resources here:

University Title IX Contact: James Vanbebber, 903-886-5996, <mailto:TitleIX@tamuc.edu>

*The syllabus/schedule are subject to change.*

University resource webpages:

SAFE Team: [https://www.tamuc.edu/CampusLife/Victim Advocacy and Support/](https://www.tamuc.edu/CampusLife/Victim%20Advocacy%20and%20Support/)

[http://www.tamuc.edu/CampusLife/CampusServices/studentRights/Title IX.aspx](http://www.tamuc.edu/CampusLife/CampusServices/studentRights/Title%20IX.aspx)

<http://www.tamuc.edu/campuslife/campusServices/universityPoliceDepartment/crimePrevention/sexualAssault.aspx>

University Counseling Center: 903-886-5145,

<http://www.tamuc.edu/campusLife/campusServices/counselingCenter/default.aspx>

Campus police: <mailto:upd@tamuc.edu>, call 911 in emergency situations

External resources:

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

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

End rape on campus: <http://endrapeoncampus.org>

Clery Center for Security on Campus: <http://clerycenter.org>

Not Alone: <https://www.notalone.gov>

## **COURSE OUTLINE / CALENDAR**

Advanced Mathematical Techniques Content Schedule

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

8/24	Week 1: Calculus review
8/31	Week 2: Calculus review
9/7	Week 3: Introduction to ordinary differential equations
9/14	Week 4: Introduction to ordinary differential equations
9/21	Week 5: Linear algebra and vectors
9/28	Week 6: Linear algebra and vectors
10/5	Week 7: Series
10/12	Week 8: Complex numbers
10/19	Week 9: Divergence, curl, and vector fields
10/26	Week 10: Line integrals, surface integrals, and volume integrals
11/2	Week 11: Line integrals, surface integrals, and volume integrals
11/9	Week 12: Differential equations
11/16	Week 13: Differential Equations
11/23	Week 14: Thanksgiving
11/30	Week 15: Differential equations

*The syllabus/schedule are subject to change.*

### Problem Set Homework Deadlines:

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

Homework 1: Calculus review	9/9
Homework 2: Intro to ordinary differential equations	9/23
Homework 3: Linear algebra and vectors	10/7
Homework 4: Series and complex numbers	10/28
Homework 5: Vector calculus	11/11
Homework 6: Differential equations	12/2

### Physics Education Research Reading Schedule:

Reading reflection homework prompts will be based on the following journal papers.

HW 1	Nguyen, "Students' understanding and application of the area under the curve concept in physics problems," PRST-PER 7, 010112 (2011).
HW 2	Van de Eynde, "Translating between graphs and equations: The influence of context, direction of translation, and function type," Phys. Rev. PER 15, 020113 (2019).
HW 3	Bing and Redish, "Analyzing problem solving using math in physics: Epistemological framing via warrants," PRST-PER 5, 020108 (2009).
HW 4	Karam, "Framing the structural role of mathematics in physics lectures: A case study of electromagnetism," PRST-PER 10, 010119 (2014).
HW 5	Klein, "Student understanding of graph slope and area under a curve: A replication study comparing first-year physics and economics students," Phys. Rev. PER 15, 020116 (2019).
HW 6	Yerushalmi, "Instructors' reasons for choosing problem features in a calculus-based introductory physics course," PRST-PER 6, 020108 (2011).

### Reading Reflection Homework Deadlines:

Homework 1	9/2
Homework 2	9/16
Homework 3	9/30
Homework 4	10/21
Homework 5	11/4
Homework 6	11/18

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

Midterm	10/14
Final	12/9

*The syllabus/schedule are subject to change.*