



## PHYS 530.01W Mathematical Methods: Analysis and Applications

COURSE SYLLABUS: Summer 2026

### INSTRUCTOR INFORMATION

**Instructor:** Dr. Robynne Lock

**Office Location:** STC 238

**Office Hours:** TBD

**University Email Address:** robynne.lock@etamu.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). This book was first published in 2016, and, in my opinion, does one of the best jobs of integrating the meaning of math with the meaning of physics I have seen in any textbook.

**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 on Perusall. These papers are all in the field of physics education research, which is recognized as a subdiscipline of physics just as particle physics and condensed matter are.

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

S. Van den Eynde, P. van Kampen, W. Van Dooren, & M. De Cock, “Translating between graphs and equations: The influence of context, direction of translation, and function type,” Phys. Rev. PER 15, 020113 (2019).

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

*The syllabus/schedule are subject to change.*

- S. Tursuca, J. Spandaw, & M.J. de Vries, "Search for symbol sense behavior: Students in upper secondary education solving algebraic physics problems," Res. Sci. Ed. 50, 2131 (2020).
- B.D. Mikula & A.F. Heckler, "Framework and implementation for improving physics essential skills via computer-based practice: Vector math," Phys. Rev. PER 13, 010122 (2017).
- J. D. Gifford & N.D. Finkelstein, "Applying a mathematical sense-making framework to students and its potential for curriculum design," Phys. Rev. PER 17, 010138 (2021).

### **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, video conference, watch YouTube videos, and use Perusall.**

#### **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. A discussion boards can be found in each advanced mathematics module for you to discuss working problems from the videos or on the problem sets with fellow students. Each reading assignment will be available for discussion in the Perusall platform. You will have an assignment due approximately every other week alternating between problem sets and reading assignments. See the schedule at the end of the syllabus. There will be 1 midterm and a final covering the math techniques content. The final is not cumulative. To earn an A in the course, you will also need to complete an annotated bibliography on math in physics and a conceptually focused math assignment.

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## 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

In this course, we will be using specifications-based grading. This is a form of alternative grading. In specs-based grading, the focus is not on assigning specific number grades to assignments and calculating averages, but rather completing specific assignments at sufficient quality. **To achieve a given grade, you must complete ALL of the required assignments listed under that grade.** I expect anybody who makes a good faith effort throughout the course to be able to obtain a B. To earn an A, you must show a deeper level of understanding. The grade scheme is as follows:

### Grade of A:

- Fulfill all the requirements for a B (see below)
- Complete annotated bibliography at sufficient quality
- Complete conceptual mathematical assignment at sufficient quality

### Grade of B:

- Complete pass 5 out of 6 Perusall assignments at sufficient quality
- Complete 5 out of 6 Problem set assignments at sufficient quality
- Pass Midterm and Final each with a percentage of 70% or higher
- Meet requirements for participation in 6 out of 7 Problem set discussions

### Grade of C:

- Complete 4 out of 6 Perusall assignments at sufficient quality
- Complete 4 out of 6 Problem set assignments at sufficient quality
- Pass Midterm and Final each with a percentage of 70% or higher
- Meet requirements for participation in 5 out of 7 Problem set discussions

### Grade of D:

- Complete 3 out of 6 Perusall assignments at sufficient quality
- Complete 3 out of 6 Problem set assignments at sufficient quality
- Pass Midterm and Final each with a percentage of 70% or higher
- Meet requirements for participation in 4 out of 6 Problem set discussions

### Grade of F:

- Does not meet the minimum requirements for a D

**Exceptions:** I am human, and I know you are too. If there are extenuating circumstances that you believe have prevented the grading system from properly reflecting your understanding and effort, please contact me, and we can talk about it. I can also be flexible with deadlines if needed.

**Details about each type of assignment follow:**

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**Perusall assignments:** Perusall is an online system that enables students and instructors to collectively discuss a text as they read. There are 6 reading assignments within Perusall for this course, each a journal paper in physics education research related to math in physics. Reading assignments are due approximately every other week. See schedule at the end of the syllabus and in Perusall itself. On each assignment, I have written a short introduction. Then you read the paper online. You make annotations (notes) as you read to share your thoughts and write questions. You can respond to each other and upvote each other. I will also be participating. I can see how much of the paper you have read and how much time you have spent reading. The system automatically calculates a percentage grade based on number and quality of annotations, interacting with each other, and time spent reading. I have set a threshold for passing. Only passing matters in specs-based grading, not a percentage grade. This should become clear with our first reading assignment, but if you have any questions, please ask.

**Problem set assignments:** There are 6 problem sets, assigned approximately every other week. See schedule at the end of the syllabus. Sufficient quality for full credit requires a good faith effort on the majority of the problems. 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 your problem set homework with fellow classmates on the class discussion boards. Problem set solutions will be made available after the deadline.

**Midterm and Final:** There will be 1 midterm and a final. See exam due dates at the end of the syllabus. The exams will be made available one week before the due date. Exams are treated as “take-home” exams. They are open note/open book and untimed. Collaboration is not permitted. The exams primarily test procedural knowledge, though some conceptual understanding is required. Percentage of at least 70% is required for credit. Retesting may be possible in extenuating circumstances.

**Problem Set discussion:** You are expected to participate in the problem discussions to discuss the sample problems from the videos or to discuss the problem set homework. To receive full credit, you must make at least 2 posts, at least one of which must be a reply to another student. Try to make posts generally within the time frame of the relevant unit.

**Annotated bibliography:** An annotated bibliography is a reference list with comments (annotations) on each reference. Details for this assignment will be included in another document, but I will include a brief summary here. Inspired by the reading assignments in Perusall and your own interests, you are to locate 5 journal papers on a *specific topic related to math in physics*. For each paper, you will write a summary, a reflection on how useful the paper is for teaching practice, and ideas for lessons the paper has given you. Requirements for “sufficient quality” will be included in the other document with full details. Peer review will be conducted about two-thirds of the way through the semester. The final version will be due at the end of the semester.

**Conceptual mathematical assignment:** The problem sets and exams involve a fair bit of procedural knowledge, but this assignment will focus more on your conceptual understanding of the math content in a physics context. Full details of this assignment will be included in another document, but I include a brief summary here. You will read specific portions of your textbook and respond to provided prompts primarily in written form. Drawings, graphs, and equations can be used supplementarily. Requirements

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for “sufficient quality” will be included in the other document with full details. You will have the entire semester to work on this project.

## COURSE OUTLINE / CALENDAR

### Advanced Mathematical Techniques Content Schedule

Weeks are labeled by the Monday of each week.

6/1	Week 1: Calculus review
6/8	Week 2: Introduction to ordinary differential equations
6/15	Week 3: Linear algebra and vectors
6/22	Week 4: Series
6/29	Week 5: Complex numbers
7/6	Week 6: Divergence, curl, and vector fields
7/13	Week 7: Line integrals, surface integrals, and volume integrals
7/20	Week 8: Differential equations
7/27	Week 9: Differential Equations
8/3	Week 10: Finals week

### Problem Set Homework Deadlines:

Homework 1: Calculus review	6/10
Homework 2: Intro to ordinary differential equations	6/17
Homework 3: Linear algebra and vectors	6/24
Homework 4: Series and complex numbers	7/8
Homework 5: Vector calculus	7/22
Homework 6: Differential equations	7/29

### Physics Education Research Reading Schedule:

Perusall assignments will be on the following journal papers.

- HW 1 D.-H. Nguyen & N.S. Rebello, “Students’ understanding and application of the area under the curve concept in physics problems,” PRST-PER 7, 010112 (2011).
- HW 2 S. Van den Eynde, P. van Kampen, W. Van Dooren, & M. De Cock, “Translating between graphs and equations: The influence of context, direction of translation, and function type,” Phys. Rev. PER 15, 020113 (2019).
- HW 3 T.J. Bing & E.F. Redish, “Analyzing problem solving using math in physics: Epistemological framing via warrants,” PRST-PER 5, 020108 (2009).
- HW 4 S. Tursuca, J. Spandaw, & M.J. de Vries, “Search for symbol sense behavior: Students in upper secondary education solving algebraic physics problems,” Res. Sci. Ed. 50, 2131 (2020).
- HW 5 B.D. Mikula & A.F. Heckler, “Framework and implementation for improving physics essential skills via computer-based practice: Vector math,” Phys. Rev. PER 13, 010122 (2017).
- HW 6 J. D. Gifford & N.D. Finkelstein, “Applying a mathematical sense-making framework to students and its potential for curriculum design,” Phys. Rev. PER 17, 010138 (2021).

### Perusall due dates:

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Homework 1	6/10
Homework 2	6/17
Homework 3	6/24
Homework 4	7/8
Homework 5	7/15
Homework 6	7/29

**Exam due dates:**

Exams will be made available 1 week before the deadline.

Midterm	7/1
Final	8/5

**Annotated bibliography due dates**

For peer review	7/8
Final version	8/6

**Conceptual math assignment due date** 8/3

## TECHNOLOGY REQUIREMENTS

### LMS

All course sections offered by East Texas A&M University have a corresponding course shell in the myLeo Online Learning Management System (LMS). Below are technical requirements

LMS Requirements:

<https://community.brightspace.com/s/article/Brightspace-Platform-Requirements>

LMS Browser Support:

[https://documentation.brightspace.com/EN/brightspace/requirements/all/browser\\_support.htm](https://documentation.brightspace.com/EN/brightspace/requirements/all/browser_support.htm)

Zoom Video Conferencing Tool

[https://inside.tamuc.edu/campuslife/CampusServices/CITESupportCenter/Zoom\\_Account.aspx?source=universalmenu](https://inside.tamuc.edu/campuslife/CampusServices/CITESupportCenter/Zoom_Account.aspx?source=universalmenu)

## 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@etamu.edu](mailto:helpdesk@etamu.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

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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**

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. Other support options can be found here:

<https://community.brightspace.com/support/s/contactsupport>

### **STUDENT RESPONSIBILITIES FOR COURSE**

#### **CWID and Password**

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@etamu.edu](mailto:helpdesk@etamu.edu).

#### **Technology-Related Issues**

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 ETAMU campus open computer lab, etc.

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### **TECHNOLOGY REQUIREMENTS AND SUPPORT**

#### **Minimal Technical Skills Needed**

Students will need reliable computer and internet access for this course. Students must be able to effectively use myLeo email, myLeo Online D2L, and Microsoft Office.

#### **Learning Management System (LMS) – D2L**

All course sections offered by East Texas A&M University have a corresponding course shell in the myLeo Online Learning Management System (LMS). Below are the technical requirements:

- View the [Learning Management System Requirements Webpage](#).
- Learn more on the [LMS Browser Support Webpage](#).

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## **Technical Support**

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778. Other support options can be found on the [Brightspace Support Webpage](#).

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## **COMMUNICATION AND SUPPORT**

### **Interaction with Instructor Statement**

If you have any questions or are having difficulties with the course material, please contact your instructor. Correspondence will always be through university email (your “myLeo” mail) and announcements in myLeo online (D2L). You will not RECEIVE email through D2L, so be sure to check your ETAMU email for communication. Students are encouraged to check university email daily.

### **Include the Following in Emails with Instructor:**

- Course name and subject in the subject line (PHYS 530 Math methods)
  - Salutation (Hi Dr. Lock)
  - Proper email etiquette (no “text” emails – use proper grammar and punctuation)
  - Student name and CWID after the body of the email (possibly add to student signature on email)
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## **COURSE AND UNIVERSITY PROCEDURES/POLICIES**

### **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.

### **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 online in the [Student Guidebook](#).

Students should also consult the [Rules of Netiquette Webpage](#) for more information regarding how to interact with students in an online forum.

### **ETAMU Attendance**

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For more information about the attendance policy, please view the [Attendance Webpage](#) and the [Class Attendance Policy](#)

### **Academic Integrity**

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

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

[Undergraduate Student Academic Dishonesty Form](#)

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

[Graduate Student Academic Dishonesty Form](#)

### **Use of Artificial Intelligence**

East Texas A&M University acknowledges that there are legitimate uses of Artificial Intelligence, ChatBots, or other software that has the capacity to generate text, or suggest replacements for text beyond individual words, as determined by the instructor of the course.

Any use of such software must be documented. Any undocumented use of such software constitutes an instance of academic dishonesty (plagiarism).

Individual instructors may disallow entirely the use of such software for individual assignments or for the entire course. Students should be aware of such requirements and follow their instructors' guidelines. If no instructions are provided the student should assume that the use of such software is disallowed.

In any case, students are fully responsible for the content of any assignment they submit, regardless of whether they used an AI, in any way. This specifically includes cases in which the AI plagiarized another text or misrepresented sources

### **Students with Disabilities-- ADA Statement**

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**

East Texas A&M University

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Velma K. Waters Library Rm 162

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

Fax (903) 468-8148

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

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

### **Nondiscrimination Notice**

East Texas A&M University 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 East Texas A&M University 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 ETAMU 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.

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

### **East Texas A&M Supports Students' Mental Health – Counseling Services**

The Counseling Center at East Texas A&M University, located in the Halladay Building, Room 203, offers counseling services, educational programming, and connection to community resources for students. Students have 24/7 access to the Counseling Center's crisis assessment services by calling 903-886-5145. For more information regarding Counseling Center events and confidential services, please visit [www.tamuc.edu/counsel](http://www.tamuc.edu/counsel)

### **Mental Health and Well-Being**

The university aims to provide students with essential knowledge and tools to understand and support mental health. As part of our commitment to your well-being, we offer access to Telus Health, a service available 24/7/365 via chat, phone, or webinar. Scan the QR code to download the app and explore the resources available to you for guidance and support whenever you need it.

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As an Institutional Member of the National Association of Schools of Music, East Texas State A&M University supports the Association's commitment to student health and wellness. The following web address provides links to information for resources related to physical and mental well-being, as well as assists in offering preventative measures that students can take to avoid serious and/or chronic conditions: [Musician Health and Safety - East Texas A&M University](#)

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