Physics 270   Mathematical Methods for Physics   Spring 2026

Instructor:	Daniel Robb	Class Mtgs:	MWF 10:50-11:50 (TREX 274)
Office:	Trexler 172D	Office Hours:	T/Th 2:00-3:30
			(15 min appts via calendly.com/daniel_robb)
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Course Description:
This course treats mathematical material needed by second year physics and/or engineering science students to be prepared for upper-level courses in their majors. Topics covered include functions and coordinate systems, multivariable calculus, ordinary differential equations, separation of variables, Taylor series, Fourier series and Fourier transforms, vector analysis, linear algebra, vector calculus, and partial differential equations. The topics are scheduled to coordinate as well as possible with the topics in the courses PHYS 203 (Modern Physics) and ENGS 220 (Circuits and Electronics).

Textbook:
• D. W. Jordan & P. Smith, *Mathematical Techniques: An Introduction for the Engineering, Physical, and Mathematical Sciences*, 4th ed., Oxford, 2008   ISBN: 978-0-19-928201-2

Purpose of the Course:
The purpose of this course is to prepare students for the mathematics used in upper-level physics and engineering science major classes, by reviewing key areas from previous calculus classes and by introducing key new topics that are used across the upper-level curriculum.

Specific Goals of the Course:
1) To master mathematical topics and techniques of significance in physics and engineering.
2) To apply these techniques to understand physical phenomena and engineering problems.
3) To construct organized solutions that demonstrate logically connected steps.

Feedback and Evaluation:
I will assign numerical grades to all your work. I *may* curve your final grades (upward), but otherwise you can expect to receive an A for a 93-100 numerical semester average; A- for 90-92; B+ for 87-89; B for 83-86; B- for 80-82; C+ for 77-79; C for 73-76; C- for 70-72; D+ for 67-69; D for 60-66; F for 0-59. These are the categories and percentages that will be used:

Participation:	10%	MCSP Reflections:	5%
Homework:	35%	Three Tests:	10% each
Final Exam:	20%		

Participation: This component will consist of attendance (see below) as well as my estimation of your semester-long engagement with in-class activities.

MCSP Reflections: The MCSP department offers a series of talks each semester that appeal to a broad range of interests related to math, computer science and physics. Members of this class are invited to attend all of these talks; however, attendance for **at least two** of these talks is mandatory.

Within **one week** of attending a talk you must submit (via a link on Inquire) a full-page single-spaced paper reflecting on the discussion. (Note that for recorded talks, you may submit your reflection beyond the one-week deadline.) Your reflection should include not only a short summary of the content, but also a personal contemplation of the experience, including areas of the talk that you found particularly interesting, confusing, and/or relevant to our PHYS 270 course material.

Homework: Reading the textbook and listening to lectures are excellent first steps towards mastering new mathematical topics, but working on challenging problems involving these topics is (in this instructor's opinion) the most important step in achieving mastery. With a couple of exceptions, homework problem sets will be assigned on Wednesdays at the end of class and will be due the following Monday at the start of class. Homework sets will be returned at the start of the class after they were turned in.

Three Tests: Studying and synthesizing material before a test is a further step toward mastery of new mathematical topics. Our in-class tests will be completed individually. On tests the use of your textbook, your own notes, and your own previous graded work is allowed. If you have electronic notes, the device must have Internet access turned off. Use of the Internet (including our Inquire page), and of Mathematica or similar programs, is not allowed. A list of topics covered on each test will be posted on Inquire in advance of the test. No make-up tests will be given. If you miss a class due to illness or for another legitimate reason and let me know by email or in person in advance of the test time, your final exam grade will substitute for the missed test grade.

Final exam: The final exam will be comprehensive, though our final course topic (partial differential equations) will be covered only via a bonus problem. As on tests, you may bring and use your textbook, your notes and your previous graded work during the final exam. If you have electronic notes, the device must have Internet access turned off during the final exam (no use of Inquire during the final exam). Use of the Internet (including our Inquire page), and of Mathematica or similar programs, is not allowed. Our final class will be a review session for the final exam.

Policy on Late Work:
It benefits you to be timely and punctual with your work. Problem sets will be due at the start of class on the due date. I will grade a problem set with a 10% lateness deduction if turned in by 5:00PM on the due date. Following that, problem sets will receive a further 20% lateness deduction for each successive school day late (with days considered to end at 5:00 PM). Problem sets that are more than three days late will receive no credit.

Attendance Policy:
You must notify me in advance if you must miss class for a valid reason (an excused absence). For each unexcused absence past the third, two points will be deducted from your final semester average.

Expected Hours of Work
In this course, you are expected to spend at least 12 hours per week inside and outside of class.

Academic Integrity:

To ensure fairness across the class, the College's academic integrity policies will be enforced. On problem sets you should work individually, though you may discuss the problems with me or with a Subject tutor (see below). You may discuss course material with classmates at a conceptual level in working on a problem set, but you may not discuss the specific strategy or approach to individual problems. If you are in doubt about whether a specific collaboration is allowed, please ask me.

Regarding generative AI tools such as ChatGPT, you may use these tools as a last resort to generate ideas on a problem on a problem set, or to check a solution of your own that you are unsure about. Overuse of these tools, or use of these tools before you have given your own best effort on a problem, will result in less genuine learning and will likely lead to difficulties on in-class tests and exams. You must write up problem set solutions on your own in any case. You may not use generative AI tools on in-class tests or on the final exam.

Accessible Education Services:

Accessible Education Services (AES) is located on the first floor of the Bank Building. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Dustin Persinger, Assistant Director of Academic Services for Accessible Education, at 540-375-2248 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Dustin Persinger at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester. The testing center, also located on the first floor of the Bank Building, can be reached at 540-375-2247.

Writing Center:

The Dr. Sandee McGlaun Writing Center and Subject Tutoring, located in the lower level of the Fintel Library (Room 5), offers free one-on-one support in writing, oral presentations, and course content such as Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, and Social Sciences. Open Sunday–Thursday from 4–9 PM, students can stop by or schedule through Navigate by selecting "Schedule an Appointment" → "Writing Center and Subject Tutoring" → "Writing Support" or "Course Tutoring" → preferred date and tutor. Contact subject_tutoring@roanoke.edu or 540-375-2590 for more information.

Wk	Date	Rdg	Topic	Due
1	12-Jan	Ch 1: 2-4, 9-13	Functions/Coordinate Systems	
1	14-Jan		Functions/Coordinate Systems	
1	16-Jan	Ch 2: 1-9	Differentiation	
2	19-Jan		**MLK Day: No class**	
2	21-Jan	Ch 3: 1-9	Differentiation Rules	Homework 1
2	23-Jan		Differentiation Rules	
3	26-Jan	Ch 14: 1-3	Integration	Homework 2
3	28-Jan	Ch 6: 1-5	Complex Numbers (worksheet)	
3	30-Jan	Ch 18: 1-3	Differential Equations	
4	2-Feb		Differential Equations	Homework 3
4	4-Feb	Ch 18: 4-5	Boundary Conditions	
4	6-Feb	Ch 22: 3	Separation of Variables	
5	9-Feb		Separation of Variables	Homework 4
5	11-Feb	Ch 5: 1-8	Taylor Series	
5	13-Feb	Ch 26: 1-9	Fourier Series	
6	16-Feb		TEST 1	
6	18-Feb		Fourier Series	
6	20-Feb	Ch 27: 1-6	Fourier Transform	
7	23-Feb		Fourier Transform	Homework 5
7	25-Feb	Ch 9: 1-4, 6-8	Review of Vectors	
7	27-Feb		Review of Vectors	
8	2-Mar		**Spring Break: No class**	
8	4-Mar		**Spring Break: No class**	
8	6-Mar		**Spring Break: No class**	
9	9-Mar	Ch 10: 1-3, 9	Scalar Product	
9	11-Mar	Ch 11: 1-2, 5	Vector Product	
9	13-Mar		Vector Product	
10	16-Mar	Ch 7: 1-4	Matrix Algebra	Homework 6
10	18-Mar	Ch 8: 1-3	Determinants	
10	20-Mar	Ch 12: 1-5 Ch 13: 1-4	Row Operations Eigenvalues/Eigenvectors	
11	23-Mar		Eigenvalues/Eigenvectors	
11	25-Mar		Eigenvalues/Eigenvectors	Homework 7
11	27-Mar	Ch 29: 6, Ch 31: 4	Gradient Vector	
12	30-Mar		TEST 2	
12	1-Apr	Ch 34: 1-2, 5	Divergence, Curl, Laplacian	
12	3-Apr		**Good Friday: No Class**	
13	6-Apr		Divergence, Curl, Laplacian	Homework 8
13	8-Apr	Ch 33: 1-2, 4-5, 7-9	Line Integrals	
13	10-Apr	Ch 32: 1-2, 5-7 Ch 34: 3-4, 6	Double Integrals Surface and Volume Integrals	
14	13-Apr		Double/Surface/Volume Integrals	Homework 9
14	15-Apr	Ch 28: 1-3 Ch 17: 1-7	Partial Differential Equations	
14	17-Apr		TEST 3	
15	20-Apr		Partial Differential Equations	
15	21-Apr		Final Exam review	
15	24-Apr		Final Exam 8:30-11:30 AM	