PHYS 270: Mathematical Methods for Physics
Syllabus - Spring 2023

Location: Trexler 372
Instructor: Dr. Daniel Hickox-Young (Dr. H-Y)
Office Hours: MWF 11:00am-12:00pm;
TuTh 1:00-2:00pm;

Time: MWF 2:20-3:20pm
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Office: Trexler 266A
Phone: (540) 375-4975

Office Hours: Office hours will be held in-person in Trexler 266A. If you are unavailable during office hours, feel free to stop by any time my door is open. I'm also happy to meet by appointment via zoom using the link provided below (also linked on Inquire) if you prefer. https://roanoke-edu.zoom.us/my/hickoxyoung Meeting ID: 848 844 3643 No Passcode is required.

To schedule an appointment, either send me an email (especially if you need to meet outside normal working hours) or use calendly (which is linked to my calendar): https://calendly.com/hickoxyoung

Course 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

Prerequisites: PHYS 201, PHYS 202, MATH 122

Other required materials: You will need a writing utensil and paper as well as a working scientific calculator for class sessions, assignments, and exams.

Course Description: This intermediate-level course introduces mathematical topics needed by second year physics majors to be successfully prepared for handling upper-level physics courses. Topics are designed to elucidate applications in physics using vector analysis, coordinate systems, matrix methods, ordinary differential and partial differential equations, Div-Grad-Curl techniques, infinite series, complex analysis, Fourier and Laplace transforms.

Learning Outcomes: Upon successful completion of the course, students will be able to:

- Master mathematical topics and techniques of special significance in physics and Engineering
- Formulate physical phenomena in mathematical terms
- Apply these techniques to model and interpret physical phenomena and engineering problems
- Construct organized physical analyses and solutions that demonstrate logically connected steps

Lecture Periods: The lecture will cover topics outlined in the course schedule and will involve solving sample problems, so student involvement and teamwork are expected. Any question is welcome in class at any point!

Attendance Policy: If you have a temperature of 100.4 or higher or other COVID symptoms, don't come to class. Call Health Services IMMEDIATELY. Do not come to class or go to any public area on campus. In order for your absence to be excused, you must give Health Services permission to notify me that you have consulted them about COVID symptoms. If Health Services informs you that you should isolate and not attend class for multiple days, inform me so that we can make a plan to keep you current in the course. All absences caused by consultation with Health Services about coronavirus symptoms or isolation ordered by Health Services will be excused but you will need to do the work and graded assignments even if we extend a deadline for you.

Formal attendance will not be taken in this class. However, I will be assessing your participation in the course based on your engagement with a variety of activities which will take place during class. You are fully responsible for the material that was covered and for any announcements made during class meetings. As with problem sets (details below), in order to receive participation credit for a class you have to be absent for, please discuss the details with me either in person or via email prior to the start of class.

Homework: Problem sets will be regularly assigned from the textbook and other sources (outside problems will be scanned and posted on Inquire). <u>These are due in physical format at the beginning of class.</u> Late homework assignments will be eligible for full credit if discussed and approved prior to the beginning of class (with exceptions under extenuating circumstances, i.e. illness, family emergency, etc.). "No-call no-show" (i.e. no communication prior to the due date) late homework assignments will still be eligible for up to 75% of the grade they would have earned if turned in on time.

Graded work will be handed back in class.

Some exercises in each problem set will be graded for accuracy in order to give detailed feedback on your work. The remainder of the problem set will be graded for completion.

Exams: There will be three take-home mid-term exams and a non-comprehensive final examination, with their dates specified in the course schedule. Test topics will be announced in advance and posted on Inquire. Late exams will be eligible for full credit if discussed and approved prior to the beginning of class (with exceptions under extenuating circumstances, i.e. illness, family emergency, etc.). "No-call no-show" (i.e. no communication prior to the due date) late exams will still be eligible for up to 75% of the grade they would have earned if turned in on time. Exams are open-book and open-notes, see more below in the Academic Integrity section.

Grading: Class grades will be calculated according to the following distribution

- Participation 10%
- MCSP 5%
- Homework 25%
- Three Mid-term Exams 15% each
- Final Exam 15%

Furthermore, letter grades will be assigned at the end of the semester according to the following scale

A-	90-92	A	93-100				
B-	80-82	B	83- 86	B+	87-89		
C-	70-72	C	73- 76	C+	77-79		
D-	60-62	D	63- 66	D+	67-69	F	<60

You should expect to spend at least 12 hours inside and outside of class each week on this course.

MCSP Conversation Series/Extra Credit: You are required to attend AT LEAST TWO talks in the MCSP Conversation Series (schedule available at https://www.roanoke.edu/inside/az_index/math_cs_and_physics/conversation_series/spring_2023) and submit a well-written reflection on the talk within one week of the presentation (with the exception of recorded talks, which can be reflected on at any time throughout the semester). The submission must present a brief summary of the key ideas of the talk and include a description of the parts of the presentation that were interesting, confusing, and relevant to this course. Your work must be grammatically-correct, typed, double-spaced, and approximately one page in length. Note that a simple summary of the talk is not sufficient to receive credit. A guided reflection form is available on Inquire to help you complete your reflection.
Your reflection on the MCSP talk will contribute to your participation grade. For extra-credit, you may attend additional MCSP talks during the semester, and the submitted reflection(s) will contribute to your overall grade.

Use of Electronic Devices: Electronic devices are valuable tools, therefore my general policy is to allow the use of electronic devices in the classroom. Laptops or tablets may be used for notetaking during regular class sessions if this seems useful to you or even during exams if you need access to an electronic version of the textbook. Scientific calculators may be used during class when needed and during exams.

However, I expect your phones to be on silent mode and out of reach at all times, and I expect that any electronic devices will not be used to browse the internet or communicate with anyone inside or outside of class. A violation of this policy during an exam will be considered violation of Roanoke College's Academic Integrity policy, and I reserve the right to limit the use of electronic devices in the classroom if I feel this policy is being abused.

Mathematica Use: You are allowed and encouraged to check your final answers using Mathematica, only during assignments. You are NOT allowed to access Mathematica during exams. A link to download Mathematica on your personal computer will be made available on Inquire.

Subject Tutoring: located on the lower level of Fintel Library (Room 5), is open 4-9 PM, Sunday-Thursday. Subject Tutors are highly trained, current students who offer free, one-on-one (and small group) tutorials in over 80 courses taught at Roanoke College, including: Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, and Social Sciences. Check out all available subjects and schedule 30- or 60-minute appointments at www.roanoke.edu/tutoring. If you have a question, feel free to stop by, or contact us at subject_tutoring@roanoke.edu or 540-375-2590. See you soon!

Accessible Education Services (AES): located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. 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 Becky Harman, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 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 Becky Harman at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester.

Academic Integrity: Your learning and integrity are at the core of your RC education. For this reason, you must follow the rules outlined in the College's AI policies. See https://www.roanoke.edu/inside/a-z_index/academic_affairs/academic_integrity. Collaboration is an important skill that you will be asked to develop in class and in lab, and I would encourage you to extend this practice beyond the classroom as you work on problem sets. However, the final write-up should reflect your own understanding of the problem and I ask that you include the names of anyone you collaborated with when you turn in your problem set.

Exams are open-book and open-notes. All materials for this course may be consulted during an exam. This includes uploaded lectures and online versions of the textbook. The internet and computational software (i.e. Mathematica) are NOT allowed resources for an exam. Exams in this class are an individual assessment tool, so communication between students regarding exam content is prohibited until all students have completed the exam.

If I become aware of a possible violation of these guidelines, I am contractually obligated to report it to the Academic Integrity committee. The AI policy can be found online at: https://www.roanoke.edu/inside/a-z_index/academic_affairs/academic_integrity/resources_for_students

Class Environment: I consider this classroom to be a place where we will treat one another with respect, creating an environment that welcomes individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations,

sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

PHYS 270: Mathematical Methods for Physics, Spring 2023- Daily Schedule The following schedule outlines the tentative timeline for the covered topics and exam dates:

Day	***Chapter(s)***	***Sections***	***Topic***
18 Jan	9	1-4, 6-8	Introductions/Elementary Operations with Vectors
20 Jan			
23 Jan	10	1-3, 9	Scalar Product
25 Jan	11	1-2, 5	Vector Product
27 Jan			
30 Jan	1	2-4, 9-13	Functions and Coordinate Systems
01 Feb			
03 Feb	2	1-9	Differentiation
06 Feb	3	1-9	Differentiation Rules
08 Feb			
10 Feb	18	1-3	Differential Equations
13 Feb			
15 Feb	6	1-5	Complex Numbers // ***TEST I DUE***
17 Feb	18	4-5	Boundary Conditions of Differential Equations
20 Feb			
22 Feb	14	1-3	Integration
24 Feb	22	3	Separation of Variables
27 Feb			
01 Mar	28, 17	28.1-28.3, 17.1-17.7	Partial Differential Equations
03 Mar			
07-11 MAR – SPRING BREAK			
13 Mar	7	1-4	Matrix Algebra
15 Mar	8	1-3	Determinants
17 Mar	12, 13	12.1-12.5 13.1-13.4	Elementary Row Operations Eigenvalues and Eigenvectors
20 Mar			
22 Mar	29, 31	29.6, 31.4	Gradient Vector
24 Mar	34	1-2, 5	Divergence, Curl, Laplacian // ***TEST II DUE***
27 Mar			
29 Mar	33	1-2, 4-5, 7-9	Line Integrals
31 Mar	32, 34	32.1-2, 32.5-7 34.3-4, 34.6	Double Integrals Surface and Volume Integrals
03 Apr			
05 Apr	33, 34	33.6, 34.8	Green's and Stokes Theorem

07 Apr	5	1-8	Taylor Series
10 Apr	26	1-9	Fourier Series
12 Apr			
15 APR – GOOD FRIDAY – NO CLASS			
17 Apr	19	1-5	Forced Differential Equations
19 Apr			***TEST III DUE***
21 Apr	27	1-6	Fourier Transform
24 Apr	24	1-3	The Laplace Transform
25 Apr			
27 Apr	***2:00pm-5:00pm***		***Final Exam***