PHYS 270: Mathematical Methods for Physics
Syllabus – Spring 2020

Location: Trexler 263 **Time**: MWF 10:50 – 11:50
Instructor: Dr. Hiba Assi **E-mail**: assi@roanoke.edu
Office Hours: MWF 13:00-14:30, TH 11:00-12:00 **Office**: Trexler 264B
Open-door visits & appointments are welcome **Phone**: (540) 375-2570

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 working scientific calculator for class sessions, assignments, quizzes, 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 in groups, so teamwork and student involvement are expected. Any question is welcome in class at any point!

Attendance: Attendance will be formally taken in the beginning of class and will count towards your final grade. The maximum number of absences, whether excused or not, is three for the whole semester. You are fully responsible for the material that was covered and for any announcements made in class such as changes to the schedule and/or syllabus, assigned homework sets, and upcoming quizzes.

Homework: Problem sets will be regularly assigned from the textbook and other sources (outside problems will be scanned and posted on Inquire). These are due at the beginning of class on the due date.

Some of the exercises in each set will be graded on correctness to provide you with detailed feedback on your work, and the others will be graded on completion. Detailed solutions will be posted on Inquire for your use. No late submissions will be allowed unless an extension is discussed and granted beforehand.

Quizzes: One quiz per week will be given, with the details announced in class the week before. No makeup quizzes will be given.
The lowest two quiz grades will be dropped at the end of the semester.

Discussion/Review Sessions: Review sessions for exams will be agreed upon and announced in advance in class.

Exams: There will be three take-home mid-term tests and an in-class three-hour final exam, with their dates specified in the course schedule. Test topics will be announced in advance and posted on Inquire. Exam make-up for excused reasons (family commitments, medical procedures, and university-recognized commitments) must be discussed and arranged with me at least two weeks in advance, unless it is an emergency. If your missed exam is unexcused, you will receive a zero on that exam.

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

- Attendance 5%
- Participation 5%
- MCSP 5%
- Homework 20%
- Quizzes 15%
- Three Mid-term Tests 10% each
- Final Exam 20%

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 two talks in the MCSP Conversation Series (schedule available at http://cs.roanoke.edu/MCSPSeries) and submit a wellwritten reflection on the talk within one week of the presentation. 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 grammaticallycorrect, typed, double-spaced, and between one and two pages in length. Note that a simple summary of the talk is not sufficient to receive credit. You can submit ONE more write-up for extra credit up to 0.5% added to your final grade.

Use of Electronic Devices: You are allowed to use personal laptops and tablets, but only for the purpose of taking notes and using Mathematica when needed/permitted. Scientific calculators can also be used during class and exams. Your phones must be on silent mode and out of reach during class and must be turned off during exams. Violations of this policy during exams can constitute a violation of the academic integrity policy.

Accommodations : Accessible Education Services (AES) is 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 Laura Leonard, 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 Laura Leonard at your earliest convenience to schedule an appointment.

Academic Integrity: The Academic Integrity (AI) policy at Roanoke College will be thoroughly followed in this course, and I expect you to abide by all the outlined rules to avoid any questionable conduct. General concepts related to the homework sets may be clarified through conversations with other students, but you should solve the problems on your own. No discussions with others during a test allotted time is allowed. You are allowed to use a calculator ONLY to compute numerical quantities. Any other permitted resources will be announced and posted on Inquire. If I become aware of a possible violation of these guidelines, I am obligated to report it to the Academic Integrity committee. Student resources on 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: Each member of this class is valued, and is expected to 1) treat everyone else with respect and 2) contribute to a welcoming and inclusive environment.

PHYS 270: Mathematical Methods for Physics, Spring 2020- Daily Schedule Topics and their schedule will mostly be synchronized with the "Modern Physics" course, so changes to the topics/schedule could occur based on progress and need in both courses.

Day	***Chapter(s)***	***Sections***	***Topic(s)***
13 Jan	1, 39	1.15-1.18, 39.1	Introduction to Series and Probability
15 Jan	40	1-3, 5, 7-9	Probability Distributions
17 Jan			
20 Jan	41	1-5	Representing Data and Regression
22 Jan			
24 Jan	9	1-4, 6-8	Elementary Operations with Vectors
27 Jan			
29 Jan	10	1-3, 9	Scalar Product
31 Jan	11	1-2, 5	Vector Product
3 Feb	1	2-4, 9-13	Functions and Coordinate Systems
5 Feb	2	1-8	Differentiation
7 Feb	3	1-8	Differentiation Rules
10 Feb	18	1-3	Differential Equations
12 Feb			
14 Feb	6	1-5	Complex numbers/ ***TEST I Due***
17 Feb	18	4-5	Boundary Conditions of Differential Equations
19 Feb			
21 Feb	14	1-3	Integration
24 Feb	22	3	Separation of Variables
26 Feb	28	1-3	Partial Differential Equations
28 Feb			
2 Mar	Spring Break- Enjoy!!!!		
4 Mar			
6 Mar			
9 Mar	7	1-4	Matrix Algebra
11 Mar	8	1-3	Determinants
13 Mar	12 13	12.1-12.5 13.1-13.4	Elementary Row Operations Eigenvalues and Eigenvectors
16 Mar	29, 31	29.6 , 31.4	Gradient Vector
18 Mar	34		Divergence, Curl, Laplacian
20 Mar	33	1-2,5 1-2, 4-5, 7-9 32.1-2, 32.5-7	Line Integrals/ ***TEST II Due***
23 Mar	32 34	 34.3-4, 34.6	Double Integrals Surface & Volume Integrals

25 Mar	33, 34	33.6, 34.8	Green's & Stokes Theorem
27 Mar	5	1-8	Taylor Series
30 Mar			
1 Apr	26	1-9	Fourier Series
3 Apr			
6 Apr	19	1-5	Forced Differential Equations
8 Apr			
10 Apr	Good Friday- No class!		
13 Apr	27	1-6	Fourier Transforms
15 Apr			***TEST III Due***
17 Apr	24	1-3	The Laplace Transform
20 Apr			
27 Apr	***08:30-11:30***	***Final Exam- Best of Luck!!!***	