Physics 490 Senior Seminar: Capstone Spring 2020

Instructor:	Daniel Robb	Class Mtgs:	MWF 10:50-11:50 (TREX 272)
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Course Description:
This is a capstone course that captures the essence of what a Physics major is expected to know. The following is taken from the Roanoke College mission statement for students majoring in physics:
"Students majoring in physics are provided with a curriculum that emphasizes a balance of breadth and depth of knowledge of the field. Physics students learn to address real-world problems through a curriculum that provides a balance between sound theoretical frameworks and practical expertise. Graduates are well prepared for traditional and non-traditional career paths and are capable of contributing broadly to the global scientific community."

Textbooks:
- *Physics for Scientists and Engineers (with Modern Physics),* by Serway and Jewett, 9th edition
  [or an equivalent intro textbook including modern physics]

Purpose of the Course:
The purpose of the course is to review and synthesize your knowledge of introductory physics, to work on a meaningful demonstration project, and to become acquainted with the physics research literature.

Specific Goals of the Course:
1) To be conversant with the fundamental laws of physics and to be able to apply them to solve problems.
2) To be able to design and demonstrate understanding of the laws of physics through experimentation.
3) To learn to read and discuss selected articles from the physics research literature.

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 90-100, a "B" for 80-89, etc. I will assign +/- to your final grades by examining the distribution of grades. These are the categories and percentages that will be used:

Review Material (group):	20%
Oral Exam (individual):	10 %
Demo project (group):	20 %
MCSP reflections/Resume (ind.):	10 %
Article presentation (group):	20 %
Article discussions (individual):	5 %
Final Paper (individual):	15 %

Review Material will consist of groups presenting (teaching) the introductory topic for the day to the rest of the seminar class. You will be divided into groups of 4 students. You must all participate in explaining the material to the class, and engaging the class in some relevant activity (problem-solving, question and answer, discussion, etc.). Note you do not have to cover every last detail or subtopic of the day's material in the textbook, but you should cover the main ideas well.

The Oral Exam will consist of a 30-45 minute individual session with several of the physics professors in which we ask you to solve and explore several introductory problems on the board, in a low-key environment.

Demo project After changing groups into new groups of 4, you will conceive of and build a piece of demonstration equipment to illustrate a physics concept. You'll first turn in a proposal for approval by me, then work together to build and troubleshoot the piece of equipment, then demonstrate it to the rest of the class by the end of the semester.

MCSP Reflections/Resume The MCSP department offers a series of discussions that appeal to a broad range of interests related to math, computer science and physics. Members of this class are invited to be involved with all of these meetings; however participation in **at least two** of these sessions is mandatory. Within **one week** of attending a colloquium you must submit (via a link on Inquire) a two-page double-spaced paper reflecting on the discussion. This should not simply be a regurgitation of the content, but rather a personal contemplation of the experience. Note you will also be expected to create a draft of your resume as part of our discussion of career options for physics majors.

Article presentation After changing groups a second time, this time into groups of 3, you will choose a recent research article from a group of articles I will supply to you. You will work as best you can to understand the article, and then lead a discussion of the article with the rest of the class.

Article discussion You are expected to participate actively in the discussion of the articles led by other groups. In order to participate, **you are responsible for reading the articles being presented by other groups before their presentation.**

Final paper: For your final paper, you will write a report in which you explain and explore one of the four articles presented by a different group in the class. The final paper should be 4-5 pages in length, double-spaced, and should attempt to connect the physics in the article with the introductory physics we have reviewed this semester to the greatest extent possible.

Attendance Policy:
Attendance is very important. You must notify me in advance if you must miss class for a valid reason (an excused absence). Any student who misses a total of five classes unexcused will be dropped from the course with a grade of DF. A warning email (cc'd to your advisor and the registrar) will be sent after the fourth unexcused absence occurs. Note that if a student shows up for class 10 minutes late, walks out in the middle of class, or is caught napping/texting/checking emails/browsing the Internet during class, that student will be given an unexcused absence for the class.

Expected Hours of Work
As a one credit course, this course expects you to spend at least 12 hours per week inside and outside of class.

Policy on Late Work:
I will grade an assignment with a 10% lateness deduction if turned in by 5:00PM on the due date. Following that, assignments will receive a further 10% lateness deduction for each successive school day late (with days considered to end at 5:00 PM). Assignments more than two weeks late will receive no credit.

Academic Integrity:
The College academic integrity policies are vigorously enforced. You should work solely within your group (and potentially with me) on group projects, and on your own for the final paper.

Accessible Education Services: *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.

Course Schedule:

Week	Date	Topic	Deadlines
1	13-Jan	Introduction and overview	
	15-Jan	Review PSE Ch 1-3 (1-d motion, vectors)	
	17-Jan	Review PSE 4-6 (2-d motion, Newton's Laws)	
2	20-Jan	Review PSE 7-9 (conserv. energy, linear momentum)	
	22-Jan	Review PSE 10-12 (rotation, ang. momentum, statics)	
	24-Jan	Review PSE 13-15 (gravity, fluids, oscillations)	
3	27-Jan	Review PSE 16-18 (sound waves, standing waves)	
	29-Jan	Review PSE 19-22 (1st law, gases, engines/entropy)	
	31-Jan	Review PSE 23-25 (electric fields and potential)	List of demo project ideas
4	3-Feb	Review PSE 26-28 (capacitance, resistance, DC circuits)	
	5-Feb	Review PSE 29-31 (magnetic fields, Faraday's Law)	List of physics careers
	7-Feb	Work on future review classes (Dr. Robb out of town)	
5	10-Feb	Resume building with Career Center	
	12-Feb	Review PSE 32-34 (inductance, AC circuits)	
	14-Feb	Review PSE 39 (relativity)	Resume/CV draft
6	17-Feb	Review PSE 40 (intro quantum physics)	
	19-Feb	Review PSE 41 (quantum mechanics)	
	21-Feb	Review PSE 42 (atomic physics)	Demo project abstract
7	24-Feb	Demo project draft presentation	
	26-Feb	Oral Exams / Demo Project Work	
	28-Feb	Oral Exams / Demo Project Work	
8	2-Mar	**Spring Break NO classes**	
	4-Mar		
	6-Mar		
9	9-Mar	Oral Exams / Demo Project Work	
	11-Mar	Oral Exams / Demo Project Work	
	13-Mar	Oral Exams / Demo Project Work	
10	16-Mar	Overview of physics research literature	
	18-Mar	Selection of research articles by groups	
	20-Mar	Work on article reading/presentations	
11	23-Mar	Article 1 presentation/discussion	
	25-Mar	Article 2 presentation/discussion	
	27-Mar	Article 3 presentation/discussion	
12	30-Mar	Article 4 presentation/discussion	
	1-Apr	Demo Project Work	
	3-Apr	Demo Project Work	
13	6-Apr	Final paper work	Final paper topic
	8-Apr	Final paper work	
	10-Apr	**GOOD FRIDAY: NO CLASS**	
14	13-Apr	Final paper work	
	15-Apr	Demo Project Presentations	Preliminary draft of final paper
	17-Apr	Demo Project Presentations	Demo project documentation
15	20-Apr	Receive commented drafts	
16	27-Apr	Final Paper Due (No Written Final Exam)	

Note: Chapters indicated as PSE are from Physics for Scientists and Engineers, Serway/Jewett, 9th Ed.