PHYS 352: *Senior Physics Project Seminar* +
PHYS 351 & 353; Sr. Physics Project & Sr. Engineering Physics Project
Fall/Spring 2014/2015

Students in the Engineering Physics must be enrolled in PHYS 353 and PHYS 352 concurrently. All other physics majors must enroll in PHYS 351 and PHYS 352. All three courses extend over two semesters.

PHYS 352, Senior Physics Project Seminar is taught by Prof. Petschek who will be listed as the instructor of record for PHYS 351 and PHYS 353 for the entire academic year.

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Office Hours: You are welcome any time my office doors are open, although if busy I may ask you to return latter. I maintain an open google calendar which you can consult to discover if I am likely to be in. Generically, this is 9am- 5pm *unless* I am listed as busy on my calendar *or* you have made arrangements outside that time. I am often here outside that time, and you should not be bashful about asking for appointments outside that time. Early morning (between the hours of 8 am and 10 am) I am often in with my door shut but can be disturbed. Feel free to knock, particularly during that time.

Class Hours: 8:30 am Tuesday (some weeks Thursday) or 4:50 Wednesday: check the Canvas or my Calendar. Except for presentations and unless there start to be problems, you may usually attend either class, whichever you are signed up for.

Web: Most course information will be available on the PHYS 352 Canvas web site. Information associated with the Senior Project but which we want to make available to the general public will be posted on the department Senior Project web site. Look there for a general description of the senior project program as well as instructions and forms for contracts, oral progress reports and your final paper. You will also find there records of senior projects dating back to the year 2000.

Suggested Text: *Scientific Papers and Presentations*, 2nd edition by Martha Davis, Academic Press Elsevier, ISBN: 0-12-088424-0. The campus bookstore has not been asked to stock this text.

References: The first pair of books listed below were written by a physicist.

The Craft of Scientific Writing, 3rd edition by Michael Alley; Springer, 1997, ISBN: 0387947663.

The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid by Michael Alley, Springer, 2002, ISBN: 0387955550.

The MIT Guide to Science and Engineering Communication: Second Edition by James G. Paradis, Muriel L. Zimmerman, The MIT Press; 2nd Sprl edition, 2002, ISBN: 0262661276.

Communicating in Science : Writing a Scientific Paper and Speaking at Scientific Meetings, 2nd edition by Vernon Booth, Cambridge University Press, 1993, ISBN: 0521429153.

Homework: Students will be required to make presentations, write a proposal and reports and participate in classroom discussions throughout the semester. The syllabus below provides more details. "WRITTEN" ASSIGNMENTS ARE EXPECTED ELECTRONICALLY AND, EXCEPT FOR THE CONTRACT, DRAFTS AND EFFORT REPORTS AND POSTER ARE TO BE SUBMITTED THROUGH BLACKBOARD. Drafts are to be uploaded to a shared Google Drive folder. Other written assignments are by e-mail to casephyssenproj@gmail.com, an alias for the instructor who, however, prefers to have them organized in this e-mail alias. E-mail to the instructor will be accepted, with some annoyance and a discretionary penalty, and possible need to tell me that I failed to note that e-mail.

Grades: All students who are passing receive an R grade for the first semester of these two semester courses; a normal letter grade for the entire year is assigned at the end of the second semester. Midterm grades will usually be "S". The grades of "U" at either midterm or of "I" or "F" assigned at the end of the first term are rare but important. "I" and "U" mean that you seem to be far behind, and that you must speak with me about making up your deficits. If you are assigned an "F" at the end of the second semester, you must start the course again. You will have received warning of this by midterm grades or similar, if it is a realistic possibility.

A record of your PHYS 352 grades will be available on Canvas with appropriate weightings.

Most - 80% - of the grade for PHYS 351 and PHYS 353 will be determined at the end of the project by the primary research advisor, using criteria agreed to by the faculty of the physics department. This research advisor should be a senior researcher: often a CWRU faculty member in physics, but also often a faculty member in an allied field or elsewhere and sometimes a senior research in industry. The advisor may designate another person (such as a post-doctoral candidate or graduate student) as a primary contact. Below the term "adviser" means *either* (at the choice of the adviser, expressed in the contract) the advisor or the designee.

The rest – 20% of the PHYS 351 or 353 grade is based on the "timeliness" grading for Physics 352. Roughly, this means that if the Phys 352 instructor is convinced you worked little and inefficiently, (s)he can lower your adviser's grade, while if (s)he is convinced you worked hard but didn't achieve much, (s)he can raise it.

Advisers have the option to adjust the default weighting for each category so that the rubric better suits the nature of individual projects. This rubric is:

	Maximum Score	Weight	Max Weighted Score
Knowledge of physics and mathematics and ability to apply it	100	0.05	5
Ability to design and conduct experiments or develop theory, and to analyze and interpret data and/or results.	100	0.05	5
Ability to design a system, component, or process within realistic constraints	100	0.05	5
Understanding of the importance of their project to science, engineering, and/or society	100	0.05	5
Ability to learn on own	100	0.05	5
Creativity/resourcefulness/independence	100	0.05	5
Effectiveness in working with others	100	0.05	5
Ability to communicate	100	0.05	5
Timeliness, consistency of effort	100	0.05	5
Final written report	100	0.35	35
Final oral report	100	0.2	20
Total		**1.0**	**100**

All final "written" assignments should be provided to your research advisor for discussion and comment **no later than 3 days** prior to the due date on Canvas. At my discretion, I will also make drafts, possibly commented on and possibly with e-mail comments, available to your adviser. E-mail from your adviser or a member of the Writing Resource Center to the effect that you consulted them about a substantially complete draft at least 3 days before the due date results in a 15% bonus. Doing both gets a 25% bonus.

- Advisers must approve any of your work that is made available to the public, such as SOURCE posters.
- Hopefully, we will be able to use a plagiarism detector "Turnitin" for proposals and final papers. I am not sure how this will work – we just got a site license. However, it will be set so you can see the comparison it makes with your work. If there is appreciable overlap with other works, this is NOT necessarily an overwhelming problem, provided you, yourself contributed substantially to the *writing* of these works. If there is such overlap, you should probably comment on it with your submission.

The Course Outcomes for PHYS 351/353/352 are as follows:

Upon completion of our senior project program, students should have the skills described below.

1. Carry out independent research in physics/engineering
    - Design and formulate experiments, apparatus, and/or experimental, theoretical or numerical methods for addressing forefront research topics in physics or engineering or related fields.
    - Work effectively as a member of a research team
    - Carry out laboratory, theory or numerical work
    - Analyze data and results in terms of physical and engineering principles
2. Communication skills needed for research
    - Write a research proposal

- Appreciate the potential impact of research on the scientific and engineering enterprise, as well as the potential impact on technology and society
- Communicate results in multiple formats: written, oral, and poster presentations, including formats such as progress reports which invite detailed questions from and discussions with supervisors and peers.

3. Understand professional research/engineering practices
    - Engineering design principles and practices
    - Ethical issues in research
    - Professional practices in research
    - Common processes for publishing, education, and career choices

Engineering Physics Senior Capstone Design Elements

Senior Engineering Physics students must provide an appendix to their senior project final report documenting design aspects addressed in their senior project. The design element may take a number of forms depending on the nature of the capstone project. Design elements can include: 1) Design of an experimental approach to the scientific problem. 2) Design of a numerical or theoretical approach to a scientific problem. 3) Design of an instrument, apparatus, procedure or process. 4) Design of experimental control or data analysis software. *Engineering design is the process of devising a system, component, or process to meet desired needs.* This process addresses open-ended problems that have a number of approaches to tackle the problem within multiple constraints.

To this end, appendix should contain the following sections:

1. *Problem statement*
2. *Constraints* (List of multiple constraints, specifications)
3. *Approaches* (Potential approaches to the problem that were considered)
4. *Analysis* (Analysis of approaches and rationale for selection of an approach, including information on previous work that you discovered)
5. *Iterations* (Description of iterations based on results of testing an approach)
6. *Standards* (Involvement of standards in your project such as instrument interfaces, such as GPIB, computer languages such as LabView, Matlab, etc., commercial software packages)

For further information on the design process, please see the appropriate Course Document on the course Blackboard site: "Engineering Design Process" by Seyyed Khandani, Ph.D. Note that this document refers to engineering design in an industrial context. Nonetheless, the process described can also be applied in many instances in scientific research, indicating that engineering problems are often part of the scientific enterprise. Thus, the purpose of this appendix is for you to appreciate and recognize engineering problems and the design process and to document your design activities.