SYLLABUS - PHYS 498 Senior Seminar (1 unit)
499 Seniors Honors Project (3 unit)

Professor C. Thompson*

Northern Illinois University

(Dated: Fall 2016 syllabus version 2016-1c [printed)

Fall 2016 Meeting times - Class meets Friday 2:00-4:300 pm in La Tourette Hall 227.When colloquium are scheduled, we move to the colloquium room around 3:15 pm. The colloquium runs 3:30-4:30 pm. Students are required to attend the Friday colloquium even on days when the class may not meet.

Faculty - Professor C. Thompson (815-753-1772)- cthompson@niu.edu - LaTourette Hall 207
`http://www.physics.niu.edu\~cthompson`
Office hours - Tuesday 1:30 - 3pm but preferred time is appointment by mutual agreement. Please just go ahead and contact me!
Students should plan to meet regularly with their faculty mentor for their project. (Urge the faculty mentor to have a reserved weekly time to meet.)

Textbook -
No Required Textbook - However, students will use the library databases and other options for their independent research project

Table II for Fall semesters lists all potential class meeting dates and the due dates by week in semester. Spring semester has one more 'week' (due to Spring break taking up one week) Deadlines are FIRM!

The Honors Senior project (3 credits) has same core level requirements as PHYS 498. In addition, the senior project requires the student to complete a more substantial laboratory or theoretical research or inquiry project with a faculty mentor than expected in PHYS 498. The paper and presentation should be based on this project.
All projects and topics require a faculty mentor and the approval and agreement of the mentor to advise the project. If you lose your faculty mentor for reasons related to unsatisfactory progress during the semester, it will lead to a failing grade. Be sure to stay in regular contact with your faculty mentor.

I. CLASS INFORMATION AND CONTEXT

PHYS 498 and PHYS 499 are capstone courses for the physics senior. The course provides a final meaningful engagement opportunity for students in physics. Expectation is that the student will take the course his or her final semester.

The results of the papers, presentations, exams and interviews from this course are also used as part of the Physics Department's assessment data and will be used to improve the quality of the department's programs.

Components of the course are

- Guided inquiry into a research topic of interest to student and faculty mentor
- Written report on the topic - evaluated by faculty
- Oral Presentation on topic during the Senior Symposium - evaluated by panel of physics professors
- Particiation in a standardized exam or similar department assessment measure, and in an exit interview
- Attendance at the department Friday colloquiums and the class sessions prior to the colloquium.

Catalog descriptions:

PHYS 498. SENIOR SEMINAR (1 credit) Topics of current interest in physics and physics education. Attendance at the Department of Physics colloquium series required. PRQ: PHYS 374 and senior standing in physics.

PHYS 499. SENIOR PROJECT IN PHYSICS (3 credits) Program of study and research in a special area of physics selected in consultation with a faculty member and approved by the department chair. Project results evaluated by a faculty panel. A student who receives credit for PHYS 499H may not also receive credit towards the major in PHYS 459. PRQ: PHYS 374 and senior standing in physics.

* Your e-mail address; Your web page

TABLE I Weights for grading. Note that for both PHYS 498 and PHYS 499, the same non-graded requirements are applied and student may not pass (is given an F automatically) if the colloquium attendance or physics knowledge assessment activity requirements are not met.

Activity	Phys 498(1 unit)	Phys 499(3 units)
Written Report	20	25
Public Presentation	20	20
Other Five assignments	30	25
Meeting Deadlines	20	10
Faculty Mentor Input	10	20

II. DEADLINES FOR MAJOR ASSIGNMENTS

See section IV for more detailed descriptions of the assignments. See Table II and Table III for deadline dates in respective semesters.

- DEADLINE ONE - *Topics signed off by mentors and tentative working title and abstract or work scope and timeline submitted*
- DEADLINE TWO - *Extended outline and listing of primary literature identified with descriptions*
- DEADLINE THREE - *Draft report due*
- DEADLINE FOUR - *Peer Review of classmates's Draft report*
- DEADLINE FIVE - *Draft of presentation*
- DEADLINE SIX - *Presentation*
- DEADLINE SEVEN - *Final Report Due*

All assignments are to be turned in to the faculty mentor, as well as the instructor. Electronic versions (pdf files) are preferred.

In addition to a credible effort related to the assignment, please make sure that every assignment includes 1) student full name, 2) mentor name, 3) date or semester, 4) current working title of project (this can evolve over the course of the semester!) 5) Description of 'deadline' being met (e.g., 'workscope', 'extended outline',...)

III. GRADING AND GRADING POLICIES

Assuming that the attendance requirements are met, as well as the assessment participation activities (see Section III.A, the final letter grade will be determined as follows.

- Written report 30%

  Written report (Assignment seven) loses one letter grade for every 4 days past due date.

- Public presentation 25%

  The presentation symposium date is typically the last Friday colloquium of the semester. It is announced during the first class of the semester, as well as being posted on Department Colloquium web. (Unexcused absence = grade of F.).

- The average grade for the other 5 assignments (work scope, outline and literature list and description, draft report, peer review, draft presentation) count for 25% of final grade.

- Satisfactorily meeting the seven deadlines for the assignments listed in the timeline 20%

  – Successfully meeting the deadlines for assignments is worth 5 points per assignment. Get a least a credible effort in on time. One point is deducted for each day late. A missing assignment (> 2 weeks late or lacking a minimum of credible effort) gets a zero for meeting deadline and a -5 point penalty. Copies of assignments must be submitted to faculty mentor and to the instructor or they may not be given credit for having met the deadline.

  – Grading A≥31 pts; B≥26 pts;C≥21 pts;D≥15;F<15 pts;

Assignments over 2 weeks late will not be accepted for credit.

Please provide electronic copy of all assignments to instructor and to faculty mentor. Electronic copy is due at 6pm of the due date unless otherwise specified. For any documents where the formating and pictures are important (typically the draft paper and the final report), the best format to provide is PDF to avoid cross-operating systems issues and incompatibilities. The PPT, ODF, or PDF version of the presentation is due 24 hours before the symposium so that all the presentations are loaded and tested on the presentation computer in time for the symposium.

A. Additional Non-graded Requirements required to receive a Passing grade

Please note that to pass this course, a student is required to:

- Attend 3/4 or more of the class sessions during the semester.
- Attend 3/4 or more of the scheduled colloquiums during this semester.
- Participate in an exit interview (either on-line or face-to-face).
- Participate in the physics knowledge assessment exam.

TABLE II Timeline - Fall semester

Week 1	Overview of course, discuss potential topics
Week 2	
Week 3	*Due date ONE:* Topics signed off by mentors and tentative working title and work scope and timeline submitted
Week 4	
Week 5	
Week 6	Department Physics Exam Scheduling session
Week 7	*Due date TWO:* Extended outline and listing identifying primary literature is due.
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	*Due date THREE:* Draft paper
Week 13	*Due date FOUR:* Peer review of draft paper
Week 14	*Due date FIVE:* (*Tuesday*) Presentation Draft {THANKSGIVING BREAK}
Week 15	*Due date SIX:* Senior Seminar Symposium
Week 16	*Due date SEVEN: (Monday)* Final Report FINALS WEEK also, Please complete on-line Exit interviews.

TABLE III Timeline - Spring Semester

Week 1	Overview of course, discuss potential topics
Week 2	
Week 3	*Due date ONE:* Topics signed off by mentors and tentative working title and work scope and timeline submitted
Week 4	
Week 5	
Week 6	Department Physics Exam Scheduling session
Week 7	*Due date TWO:* Extended outline and listing identifying primary literature
Week 8	
Week 9	{SPRING BREAK}
Week 10	
Week 11	
Week 12	*Due date THREE:* Draft paper
Week 13	*Due date FOUR:* Peer review
Week 14	*Due date FIVE:* Presentation Draft
Week 15	*Due date SIX:* Senior Seminar Symposium
Week 16	*Due date SEVEN: (Monday)* Final Report (note: Friday is always READING DAY)
Week 17	FINAL WEEKS, please complete on-line Exit interviews

Students demonstrate their knowledge of physics by taking a physics examination and this is used in department assessment activities. The format of this assessment is undergoing review and may be changed from a multiple choice exam to something different, however, in the past, this exam consisted of 48 multiple choice questions on topics covered in 200 level courses. The topics covered are split between mechanics, waves, thermal physics, electricity and magnetism, relativity, and quantum physics. The questions are similar to what would appear on a GRE exam.

Students will be asked to share their opinions on their preparation in physics during an on-line exit interview.

B. Outline of course

Table II and Table III lists all potential class meeting dates and the due dates by week in semester. Spring semester has one more 'week' (due to Spring break taking up one week) Deadlines are FIRM!

Deadlines - Typically electronic version of assignments is required. Meeting all the deadlines and submitting appropriate documents related to these assignments are used in the final grade so ignore them at your peril. Meeting deadlines satisfactorily and reporting on their effort, and understanding assignments, is part of what makes someone successful in their profession.

IV. ADDITIONAL DESCRIPTION OF ASSIGNMENTS

A. DEADLINE ONE - Topics signed off by faculty mentors and tentative working title and abstract or work scope and timeline submitted

Expectation is an informal document of about one page. Body of document is a short description of the topic agreed upon between mentor and student. A timeline should be listed such as when various steps of the project or library research will be completed.

The faculty mentor and the student should be in agreement!

B. DEADLINE TWO - Extended outline and listing of primary literature identified with description of each source.

Extended outline should be detailed - that is, show evidence that the student has started to understand what will fit into the report, what needs to be in the report, and that he/she has made progress!

Primary literature listing MUST include at least one primary source from typical research quality or archival (e.g., peer reviewed, published) literature. This citation should be appropriate to the topic of the paper. While the preprint of an article that satisfies this requirement may be available on arXiv (a preprint server), student MUST give full citation, that is, cite the article with its published coordinates (journal, volume, etc). The arXiv preprint url can also be added in the citation, but alone it is not sufficient to satisfy this requirement.

Note, Physics Today, Scientific American, trade jour-

nals and textbooks are important sources of information and should be cited when relevant, but they are not considered research sources.

The literature listing must be written using a standard technical formatting scheme (such as in Physical Review Letters, e.g., Authors, Journal name, volume, pages, year). However, because this is a student paper be sure to include the Title of the articles and sources, and avoid abbreviations for the journal title.

In the primary literature listing, For each source, include at least ONE sentence that describes what you expect from this source. This is to demonstrate that you have started scanning (reading) the literature.

C. DEADLINE THREE - Draft report due

The draft is expected to be somewhat 'drafty'. However, by this time, the student should have a pretty good idea of what must be in introduction and background, and what is still needed and can describe what he or she expects to put in various sections. These drafts will be distributed to another student for the peer review exercise.

D. DEADLINE FOUR - Peer review of classmates draft report

E. DEADLINE FIVE - Draft of presentation

Typical format is powerpoint or a pdf of slides. Pdf version is preferred.

F. DEADLINE SIX - Final presentation

Follow a conventional scientific presentation format. Typical format is powerpoint, open or libreoffice, or a pdf. Particular attention must be paid to providing proper credit and references for any figures or graphs used from the literature, (this includes using figures from web pages).

Presentations, with questions, will be limited to 15 minutes in length and be structured in a standard symposium format and performed during the Senior Seminar Symposium. This means that speakers should prepare a 12 minute presentation, leaving time for about 2 1/2 minutes for questions, and about 30 seconds for one speaker to sit down and the next to take his or her place and be introduced. (And time for the applause!).

G. DEADLINE SEVEN - Final report due

Expectation is a standard technical formatted report with good organization, good grammar, spelling, and focused on the project. Pdf version is preferred.

It is expected that the student will reference the research literature and that the bibliography will include scholarly research literature from refereed (archival) journals appropriate to the topic of the paper. **At least one citation must be from a primary source from typical research quality or archival (e.g., peer reviewed, published) literature.** While the preprint of an article that satisfies this requirement may be available on arXiv (a preprint server), student MUST give full citation, that is, cite the article with its formal published coordinates (journal, title, volume, etc). The arXiv preprint url can also be added in the citation, but alone it is not sufficient to satisfy this requirement.

Citation format may use standard formatgin of student's choice (e.g., from Physical Review B or Journal of Applied Physics, *etc.*) *However,because this is a student paper, the title of each source must be included in full, and the journal should be written out (not abbreviated or shortened).* s.

The literature listing must be written using a standard technical formatting scheme (such as in Physical Review Letters, e.g., Authors, Journal name, volume, pages, year). However, because this is a student paper be sure to include the Title of the articles and sources, and avoid abbreviations for the journal title.

The paper should be of sufficient length to document the student's understanding of the topic covered. The department is looking for *understanding of physics*, particularly of the topics as covered at the UG level, and the students ability to apply those topics to explain his or her project. The body of the paper (excluding diagrams, graphs or appendices) might average 6-10 pages for typical student effort.

Particular attention must be paid to providing proper credit and references for any figures or graphs used from the literature, (this includes using figures from web pages).

V. FACULTY MENTOR ROLE

The single most important task of all faculty mentors is to provide guidance during the initial decisions that outline the topic and boundaries of a project. The project should be appropriately challenging, yet also have a good chance of successful completion by the student in 8 to 10 weeks. The topic need not be new topic for the student and mentor (for example, if the student and faculty have been working on a URAP project or undergraduate research, the additional research and writing for the report can be on the same topic.). The report should not be submitted for credit in another class however it may be an article (first author student) that is being published for a conference or in the literature as long as the student was responsible for the writing, and that the mentor and student describe honestly and transparently how much was altered by the mentor to make it publication ready.

A very active role would entail the mentor providing ongoing suggestions and resources for laboratory or theoretical work to support the topic, and multiple critiques, and advice on the paper and presentation preparation. Most

mentors will provide less active guidance. This level of interaction is between the student and the mentor. At minimum during the project, the mentor will encourage the student to make the deadlines and will be available for questions to help understand the material.

- Provide guidance during topic choice and initial title and draft abstract construction.
- Encourage students to stay on top of the deadlines.
- Be available for student's questions.
- Help read the paper drafts and provide feedback during the process
- Attend the presentations.

Faculty mentor: If the student is not showing up for meetings, and is not doing the work, please contact the Phys 498/499 instructor and discuss the issues.

Note that a student who goes 'ghost' and misses multiple meetings with the faculty mentor (and cannot be contacted after repeated attempts) will be removed from his/her presentation slot at the symposium, and will be dropped from the course.

Student: If a student is having problems with his/her faculty mentor that might be helped with mediation (personality mismatch, miscommunications, (or if the mentor goes 'ghost'!), please, be proactive and contact the Phys 498/499 instructor or the chair of the department with the concerns. If the situation is outside of mediation (i.e., unprofessional behavior) please contact the instructor or chair as soon as possible.

VI. USEFUL LINKS

The class meeting times before the colloquium, and on days with no colloquium, will be used to assess and discuss students progress on the course requirements and deadlines and any issues related to that. It also will be used for short discussion on themes of professionally relevant interest such as those in the following.

- "Ethics and professional conduct in science and education"
  `www.aps.org/programs/education/ethics/resources.cfm`
- "Writing and presenting for the audience"
- "Making the switch from apprentice to master"
- "Using the library and finding sources"
- others as suggested by students

TABLE IV Faculty and their suggestions for topics. For faculty who have not suggested topics, please check their recent scholarly publications to find their interests and expertise.

Jahred Adelman	The Higgs boson: Why was it needed, and how was it discovered? The Standard Model: Why is it incomplete, and where might we find new physics?
Gerald Blazey	*Not available, on leave from department*
Dennis Brown	...
Dhiman Chakraborty	The mysteries of dark matter and/or dark energy. The universal preponderance of matter over antimatter. What is the origin of mass?
Omar Chmaissem	...
George Coutrakon	...
Bogdan Dabrowski	Energy conversion: Thermoelectrics and Solid Oxide Fuel Cells. Energy utilization: Oxygen Storage and High Temperature Superconductors. Multiferroics and Magnetic Semiconductors for Spintronics. Paradigm of oxides orbitronics: Creating order at atomic scale.
Bela Erdelyi	Particle Accelerators: Their Science and Applications.
Michael Fortner	...
Andreas Glatz	...
David Hedin	Detecting particles and searching for new phenomena.
Yasuo Ito	Electron Tomography.
Laurence Lurio	X-ray lasers. Thermodynamics of membranes.
Stephen Martin	Triggers for new high energy physics discoveries at the Large Hadron Collider. (*The student will learn the basics of the requirements for new particle discoveries at the LHC, including the meaning of a 'trigger' and some of the more important examples. The end product will include a simple table listing as many as possible of the triggers used in searches at the LHC, including the recent discovery of the Higgs boson*).
Susan Mini	*Not available* (on assignment Provosts office)
Philippe Piot	Photon and Electron beams: Interactions, Synergies and Applications.
Young Min Shin	...
Carol Thompson	Green droop problem in InGaN LED's. Are bananas ferroelectric? – a cautionary tale. Atomic Force Microscopy studies of surfaces (requires some time at Argonne and can include a laboratory component using the AFM at Argonne). X-ray reflectivity as a probe of film structure (requires use of matlab).
Michel van Veenendaal	Observing changes with X-rays in a split picosecond. X-ray absorption and X-ray scattering.
Roland Winkler	Aharonov-Bohm effect (a "quantum paradox": tuning the intereference of electrons by means of a magnetic field though the electrons never "see" the field) Berry phase (another "quantum paradox": if we "rotate" a quantum system by 2pi, it can be different from the system before the rotation). Schrodinger's cat (another "quantum paradox": Why is Schrodinger's cat dead and alive at the same time?). Datta-Das spin transistor (a transistor that uses the electrons' spin degree of freedom instead of the electric charge of the electron). Coulomb blockade and single-electron tunneling (in the nanoworld, one electron more or less on a device can make a big difference). Giant magnetoresistance (tuning electric resistance by means of a magnetic field, useful for modern harddisk read heads).
Zhili Xiao	Nanoscale Superconductors. Nanomaterials based gas sensors. New superconductors.