COLORADOSCHOOLOFMINES

Subject: PHYSICS Number: 326

Course Title: Advanced Laboratory II

Section: all

Semester/year: Spring 2017

Instructors or Coordinators: Dr. Uwe Greife, Dr Lawrence WIENCKE Dr. Ed Cecil

Contact information (Griefe) Pines trailer (west campus road), ugreife@mines.edu

Contact information (Wiencke) Timberline 2 trailer (west campus road), lwiencke@mines.edu

Contact information (Cecil) Timberline 1 trailer (west campus road), fcecil@mines.edu

Office hours: Greife: Mon 8-11, 2-4

Wiencke: Mon / Wed 3:30-5:50pm wiencke@mines.edu

Class meeting days/times:

Tuesday 8:00-11:30 am and 12:30-4:00 pm (Griefe)
Thursday 8:00-11:30 am and 12:30-4:00 pm (Wiencke, Cecil)
Note: Every section does not meet every week. Students are responsible for looking up the schedule for their section on the course website (listed below) and updating their personal calendars with that information.

Class meeting location: Volk 222

Web Page: http://astroserve.mines.edu/ph326/2017/

Teaching Assistant Dan Shields,Jonathan Karpesky
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Instructional activity: _1_ hours lecture _3_ hours lab _2_ semester hours

Course designation: ___ Common Core ___ Distributed Science or Engineering

__X_ Major requirement __ Elective ___ Other (please describe _____)

Course description from Bulletin: Continuation of PHGN315. A writing-intensive course, which expands laboratory experiments to include nuclear and solid state physics. Prerequisite: PHGN315. 1 hour lecture, 3 hours lab; 2 semester hours.

Course objectives: This second part of the advanced laboratory sequence deals predominantly with radiation detection techniques in nuclear and particle physics, this is only a framework to carry out measurements and interpret results objectively with a special emphasis on experimental techniques, careful error analysis and report writing skills.

Textbook and/or other requirement materials:
Recommended text: N/A
Other required supplemental information: N/A

Student learning outcomes:
1. Students should be able to understand the basic experimental concepts highlighted in the laboratory.
2. At the end of a lab, students should be able to explain coherently what their experimental apparatus actually measured and how.
3. Students should become familiar with various radiation detection and measurement techniques.
4. Students should become proficient using equipment in the course including oscilloscopes and multi-channel analyzers.
5. Students should improve their skills and experience in selecting and applying various laboratory diagnostic techniques to get their experiments to work and to verify that their experiments are actually working properly. An important part of this is the ability to carefully diagnose and correct a simple hardware problem without causing more problems.
6. Students should be able to carry out proper error analysis, including error propagation and fit of the experimental data including error bars (vertical and horizontal, if applicable).
7. Students should be able to write a clear and concise standalone report including an abstract, introduction, apparatus description, and their observations, measurements, analysis and interpretation.

Labs:
1. (Core) Basic phenomenology of NaI(Tl) gamma ray scintillation detector; MCA, statistics
2. (Core) Gamma ray attenuation
3. (Core) Half life measurements of activated aluminum
4. (Core) Using 2 gamma coincidence measurements to study antimatter annihilation.
5. (Only one of these) Gamma-gamma coincidence angular correlations using ^{60}Co source
6. (Only one of these) Alpha-gamma coincidence measurements using ^{241}Am source
7. (Only one of these) Attenuation of alpha particles in air
8. (Only one of these) Muon lifetime measurement

Policy on academic integrity/misconduct: The Colorado School of Mines affirms the principle that all individuals associated with the Mines academic community have a responsibility for establishing, maintaining and fostering an understanding and appreciation for academic integrity. In broad terms, this implies protecting the environment of mutual trust within which scholarly exchange occurs, supporting the ability of the faculty to fairly and effectively evaluate every student's academic achievements, and giving credence to the university's educational mission, its scholarly objectives and the substance of the degrees it awards. The protection of academic integrity requires there to be clear and consistent standards, as well as confrontation and sanctions when individuals violate those standards. The Colorado School of Mines desires an environment free of any and all forms of academic misconduct and expects students to act with integrity at all times.

Academic misconduct is the intentional act of fraud, in which an individual seeks to claim credit for the work and efforts of another without authorization, or uses unauthorized materials or fabricated information in any academic exercise. Student Academic Misconduct arises when a student violates the principle of academic integrity. Such behavior erodes mutual trust, distorts the fair evaluation of academic achievements, violates the ethical code of behavior upon which education and scholarship rest, and undermines the credibility of the university. Because of the serious institutional and individual ramifications, student misconduct arising from violations of academic integrity is not tolerated at Mines. If a student is found to have engaged in such misconduct sanctions such as change of a grade, loss of institutional privileges, or academic suspension or dismissal may be imposed.

The complete academic misconduct policy is available http://bulletin.mines.edu/policiesandprocedures/

Assessment & grading Procedures:
- Labs:
You will be required to complete 5 labs. The 4 labs labeled as "Core" (experiments 1 to 4), plus one more lab from experiments 5 to 9. The course will be done in groups of 2 students, so find a partner. You will have the same partner. for the semester. We expect every student to come to the laboratory prepared along the lines of the handout to each experiment and the general handouts. A written report (from every group) is due 7 days later by 6pm. The report should explicitly state how each student contributed to it. It will be graded with special emphasis on coherent writing, data analysis and error determination.

- Grading procedure:
The final course grade will be calculated as follows:

1. Lab reports: 80% of the grade
2. Preparation for lab and performance in lab: 20% of the grade
   (Pre lab quizzes may be given at the instructor's discretion)

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

Coursework Return Policy: The instructors will do their best to return homework assignments (i.e. lab reports) as quickly as possible, usually within one week but no later than two weeks after lab reports were due.
Policy on Late Lab reports: Reports are due 7 days after the lab. It allows you to work on the report while things are still fresh in your mind, and it gives a chance for the instructor to return your graded report by the time you carry out your next experiment. This way, you will be able to fold all the comments into your next report, which should be most beneficial. Because any delay on your part puts more pressure on the instructors to return your report on time, a late lab report policy will be enforced, namely: late by one day, 90% of the original grade; late by two days, 75% of the original grade; late by three days, 50% of the original grade; late by four days or more: 25% of the grade. If late by more than one day, you are also running the risk not to get your report back by your next lab session.

Absence Policy (e.g., Sports/Activities Policy): standard policy. Please let the instructor know well in advance when and why you are unable to attend labs. Participation in labs is critical.

Homework: Lab reports.

Common Exam Policy (if applicable): N/A There is no final exam in this course.