PHYSICS CAPSTONE SYLLABUS

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Project Description:

This project is a culmination of your physics learning experience. Students are expected to apply physics principles acquired throughout the year to the design of a system, component, or process. Each project includes the development and use of design methodology, formulation of design problem statements and specifications, consideration of alternative solutions, feasibility considerations and detailed system descriptions. Projects include realistic constraints, such as economic factors, safety, reliability, maintenance, aesthetics, and social impact. Students are expected to present orally their results in a series of design reviews and students document their solutions in a written report. A working prototype or detailed design, as appropriate, of their solution is required to complete the project.

Project Objectives:

The students are expected to learn and demonstrate the following abilities:

1. To solve open-ended problems,
2. To learn and effectively utilize the engineering design process to solve a real-world problem
3. Apply physics concepts and other science and math skills to implement a solution
4. To effectively communicate ideas in a written and oral format,
5. To effectively engage in scientific, peer-reviewed discourse around the presentation of their ideas;
6. To effectively work in a team,
7. Develop critical self-evaluation and risk evaluation techniques.

Project Topic:

Each student group is responsible for choosing their own topic and having the topic approved. The topic choice is entirely up to the group, with the following guidelines/ restrictions:

1. Projects should be a solution to a non-trivial problem that improves people's everyday lives or impacts the community. Project work should be proven non-trivial through an analysis of its impact on others or on the environment.
2. Projects must be broad enough in scope (difficult enough) to warrant a half or full year of work.
3. If there is already an available solution to the problem, the project should provide a significant and needed improvement to the current solution.

Deliverables:

Each group is responsible for turning in pieces of work that serve as a documentation of their capstone. These deliverables should culminate in a portfolio that students can present in addition to their final solution.

1. A statement of the problem or need that the group wishes to resolve;
2. A research log that contains a breakdown of the following:
    - Full theoretical explanations of the physics principles that the group will need to study or use in order to understand how to solve the problem or improve a

previous solution to a problem;
    - Research about how others may have gone about solving the problem;
    - A full bibliography (APS format or other) that accurately cites the sources used.

3. A log of the possible solutions that have been developed by the group to solve the problem (with drawings or diagrams), and a documented determination of which solution the group wishes to pursue or build;
4. A full breakdown of the testing and evaluation of the prototype or solution, including numerical data and failure analysis if necessary;
5. Next steps that your group would take for a redesign.
6. Three design reviews (presentations) spaced throughout the project: Initial research and problem statement, possible solutions and prototyping, final design presentation
7. Final poster detailing research, prototypes, designs, and final solution

These deliverables can be turned in as a binder, a group notebook, or some other format.

Assessment:

Because this capstone project is a learning experience, it will not be assessed in a formal way. Instead, the aim of the project will be to complete the capstone and engage in formal discourse around each group's work, as scientists and engineers would. This project will be given an (Exemplary) (A) grade upon its full completion.

Timeline:

This capstone project will be completed over the course of the Spring Semester. There will be three milestone presentations that will be given by each group at different points throughout the semester. This will allow each group to account for their work and keep up with its completion. Each group will present to the class and to the instructor:

1. The problem that they to solve and the initial research about the problem, including a bibliography of sources that they found in their research (week 4);
2. The possible solutions that they have brainstormed and the solution that they chose to implement, including the method that they used to determine which solution to implement (week 10);
3. A final evaluation of the prototype, the results of any testing done with that prototype, and any proposed next steps or redesign work (week 16).