04/15/2019

Scientific Research and Design 2019-2020

Desired Pre-Requisites: Completion of or co-enrollment in AP Chemistry, AP Physics, and AP Calculus BC will help ensure success in this course. Also, permission from the instructor is required. You should come to the class prepared to research a project in Math or Science that interests you. You should have a project mentor BEFORE the course begins in August. The more math and science background you have before the course, the more you will get out of the activities we do in class. Also, your project will likely be better conceived and executed if you have some math/science coursework completed.

Course Description: You should come to the class prepared to research a project in Math or Science that interests you, aligned with a mentor in a company or university. Typically the research happens off-campus, on your time, pre-arranged with your mentor. You will be expected to regularly update the class on the progress of your project following a timeline that I provide. The project should be at a level suitable for entry into a competition such as the Siemen's High School Science Program (unfortunately defunct but that level of quality is expected). The course will consist of some in-class assignments that may include collecting and analyzing analytical data, and/or reading and writing about the philosophy and development of the Scientific Method.

In-Scope fields of study: Any STEM or closely related field is acceptable. For example, in the past we've had students apply statistical analysis to data from Houston elections. Students have written and analyzed original code for AI applications. Students completed a psychology or learning-style type project that was acceptable because of the application of mathematical analysis to the raw data. Most projects fall into the categories of math, computer science, biological/medical sciences, physical sciences, or engineering.

Mentors: Because of the large medical infrastructure in the Houston area, we tend to get a lot of mentors in medicine. UH, Rice, and Texas AM have also been sources for finding mentors. Occasionally, mentors from out-of-state or out-of-country have participated. Graduate or junior-senior level undergraduate students actively involved in research are also great mentors. *Be warned: I have no special skill or extensive connections for getting mentors. Don't come to class expecting me to assign to you a mentor.*

Text: "*Exploring the Scientific Method"*, Steven Gimbel, editor. This is a college-level text used to support "philosophy of science" type courses. It's around $30-40, *paperback*, on Amazon. You may be able to get it cheaper but that's more or less what it costs. Other reading materials and course content will be provided by me.

Student Expectations:

- *Secure a mentor this summer. This is your most important task.*
- The project must be original and NEW. "New" means that you can't come in with a completed project and expect to sit around and do nothing. That will be grounds for me to have you removed from the course. If you have a completed project, why take SRD?
- The project must be a stretch for you. Expect to work beyond the HS level and think beyond the courses you've taken so far.
- At the end of the year we will have a poster session in the library or cafeteria and I will invite teachers and administrators from inside and outside of DHS. Successfully choosing a project and mentor EARLY and setting goals EARLY avoids embarrassment later. We want top quality projects that look professional and that you are proud to present to outsiders.
- If you simply join a project in progress under your mentor or take a small piece of a project from your mentor's research activities, that is fine. See the next bullet.
- Mentors are critically important but you must strive to understand the project, contribute to it, and be able to explain it clearly and simply. You don't get credit for someone else's work. Be a good contributor and good steward of the work because your effort will represent, you, your mentor, your mentor's institution, and DHS.
- Regular contact with the mentor is necessary. Remember that when you choose a mentor. Long distance mentors are acceptable if the project can be completed successfully with this arrangement.
- I would prefer that students form teams of 2 or 3 students. That reduces the number of mentors and obviously reduces the number of projects we will commit to producing during the year.
- Always be prepared to give updates to the class in the form of an oral presentation. The class and I will judge the quality of your work and progress.
- Posters and research papers will be produced that professionally represent your work. The papers will look like publication quality reports that typically appear in research journals for the field your project is in. Posters will look like the ones that appear in "poster sessions" at professional meetings. There won't be anything that looks like a science fair board in SRD. In class I will show you examples of posters from previous projects.