ENGR-2500 Final Exam – Spring 2016

The exam is unlimited time – as long as it is delivered to me by the University deadline of:

**Noon, Monday May 9**

The exam is open book, open notes and open Internet.

You may not, however, give or receive assistance to/from others.

If you incorporate figures or text that you did not personally create, EACH of these incorporations MUST be accompanied by references or statements describing its source. Further, ALL text copied from other sources MUST be enclosed by quotation marks or given in italics. Failure to do so constitutes plagiarism.

**To reiterate: CTRL C + CTRL P w/o sources/quotes/italics = Plagiarism.**

Plagiarism will result in some combination of failure on the exam, failure in the course, or an Honor Code case. This has occurred in recent classes.

Your paper must be typed. But I do NOT insist on a hyper formal, stylistically perfect document. In fact I would much rather have a more informal document that highlights YOUR THINKING (more about this on the following pages).

1) **Your paper, together with this signed and pledged cover sheet are due in my office (Thornton E-223) as printed and signed documents by the deadline above.** If necessary, slip the papers under my door (but do NOT leave them in the box on the hallway wall).

2) **By the same deadline, via the UVA Collab dropbox you must leave me:**
   a) PDF copies of your most important source/reference papers (3 or more).
   b) An electronic copy of your exam paper (as PDF or MS Word document)

Ideally, these documents will add to the material of future classes.

Less ideally, they will be analyzed by anti-plagiarism search programs.

*On my honor as a student, I have neither given nor received unauthorized assistance on this exam.*

_________________________
(Sign name above)

(ATTACH THIS SHEET TO THE FRONT OF YOUR EXAM)
For the final exam I'd like you to investigate a real-life personal question:

You get to select the question. It should concern nanoscience and/or nanotechnology, or at least be inspired by something we have covered in the class. I want topics that are not cut and dried. I want topics on which there is still controversy, and/or for which there is still incomplete knowledge or unresolved issues. Topics where you are going to have to dig for information and, most likely, make your own tentative judgments as to the relative importance of alternate (perhaps conflicting) results.

Perhaps strangely, I do not want a super erudite compilation of research results, so polished and technically well phrased that I cannot tell if it was written by you, or by a professional investigator in the field. Instead, more than anything else, I want to be made aware of WHAT YOU HAVE LEARNED. And by extension, what you might be able to teach your peers (via material from your paper that I might incorporate in future classes). The above will account for 75% of the final exam's grade.

Part of what I very much hope this class has helped you develop is the ANALYTICAL SKILLS of identifying disconnects, and of realizing where key information is still missing, and where critical research and/or development still needs to be done. To evaluate that, in your final exam I want you to specifically call out:

**Disconnects / Omissions / Needs for Future Research and/or Development**

Under this header, I want you to elaborate on these issues as they pertain to your research topic. This can be done once, in the final section of the paper. Or, if it seems to make more sense, it can be done for each of your paper's sections. In either case your discussion of these disconnects, omissions, needs for future research will count for the remaining 25% of the final exam's grade.

**Let me provide an example:**

I have no formal training in biomed. But every semester I read student papers reporting that a new cancer drug will be a breakthrough because it employs "receptors directly targeting specific cancer cells." That is it, a one sentence explanation. And yet I keep reading about the same "breakthrough" in class after class after class.

The fact that this persists in being described as a "breakthrough" makes me VERY suspicious. It clearly hasn't broken through yet. And that suggests that it isn't anywhere near as easy as it sounds. Or that even WITH effective targeting perhaps deadly cancer drugs still linger elsewhere in the body, causing unacceptable peripheral damage.

So, if I were writing a final exam paper, as an outsider to biomed, I might well choose the topic of educating myself on how cancer drugs might be targeted. And of figuring
out WHY it may not be as simple as it sounds, and what the complications may be. Along the way, I’d probably also learn a lot of interesting biomed.

IMPORTANTLY, note that the “experts” might already have most of the answers I am seeking. No problem, this would be my personal exploration. But it does not mean that I could get away with a paper consisting almost entirely of quotes or paraphrases from those experts (using all of their specialist’s jargon). Why? Because we all know that I could assemble such quotes and paraphrases without really understanding hardly a word they were saying. Instead, I would write my own paper that clearly described, in my own words, what I had learned. A paper that would be easily understandable to other students, teaching them about the answers I found or about the informed speculation I was led to.
Researhing a topic when you are an outsider to a field:

I encourage you to get out of your comfort zone (and major) in choosing a topic. But you must then confront the challenge of breaking into a new field. Most of the information then falls into one of two unsatisfactory categories:

First, easily discovered articles written for layman (most often by laymen). These papers contain only generalized arguments and reports. They cite no specific data, or only indirect data (e.g. allusions to other papers that cite other papers that, somewhere down the chain, may finally refer to cold hard data and observations). I am very wary of such abstracted information. Busy writers often cite papers without completely understanding or even completely reading them (much less digging up the references those papers cite to justify their conclusions). A chain of citations can thus often be misleading or even blatantly incorrect! You as scientists and engineers should be able to dig deeper.

Second, an even more frustrating type of paper: The specialized paper written by a researcher, in full blown technical jargon, intended to be fully understood only by a handful of researchers working in the identical field. Here you’ll find yourself suspecting that the papers may actually contain important information but you are unsure because the ---- authors aren’t content to use English (or any OTHER broadly accepted language!!).

Your real challenge is to try and find studies at a level between these two extremes: Papers that provide overviews of research, perspectives, and summaries. But which back those up by describing concrete (fully referenced) examples of particularly significant findings or trends.

How do you do this?

Googling: I usually start with the more superficial articles. But I keep looking until I find ones that give me enough specific information that I can track down THEIR sources of information. If I am lucky, they actually give a journal reference. If I am unlucky, they only give the name of the article, or of the journal, the author, and the rough date of publication. With that fragmentary information and more Googling, I can then try to track down the sources.

Alternatively, if ALL I seem to be finding is narrow, deep and only marginally comprehensible research articles, sometimes I’ll throw in the additional Google keyword of “review” or even “ppt” (the former can pull out an article with more perspective, the latter may expose a professor’s lecture notes doing the same).

On nanoscience controversies, I’ve also found it useful to sometimes start with one of the more scientifically literate public advocacy groups. Because they ARE trying to affect public opinion and policy, they often go to particular lengths to cite scientific
papers. The webpage of supplemental materials for the final lecture names many such organizations:

http://www.virlab.virginia.edu/Nanoscience_class/lecture_notes/Nano_challenges_and_fears_Supporting_materials.htm

But given that the above organizations ARE advocacy groups, pushing their particular viewpoint, how do you then assure balance? Well, you can just continue Googling. OR you can try to identify particularly prominent research papers to which the advocacy groups refer. “Prominent” in the sense that multiple organizations refer to the same paper, or prominent in that the paper was published in a particularly high visibility publication such as Nature or Science. Chances are that people of different viewpoints will cite the same “seminal” articles (if only to dispute them). And you can find out who has cited a certain such article (and what THEY have published) by entering the title of that seminal article into Google Scholar (or its predecessor “Science Citation Index”).

But what if, online, you find the article’s title and abstract but are then asked to pay before you are allowed to see a copy of the full article? Go back to the page that gave you the title and abstract, and copy its URL into a text file or Word document. Then come onto grounds and use a UVA computer to go back to the same URL. Most often you’ll find that the request for payment disappears and you can download a full pdf version of the paper. This occurs because the on-grounds computers identify your request as coming from UVA which, in most cases, has paid up subscriptions to the journals!

Download and clearly retitle those papers (as most will have default titles that tell you ~ nothing about their content). Remember that I require you to submit a pdf format copy of these papers to UVA Collab.

Before long you should be neck deep in apparently relevant articles (in preparing some of my lectures, I’ve netted 1-2” thick piles of downloaded papers per hour of online research).

But now comes the most important part of the final: I want you to analyze those papers so that you can begin to state some tentative conclusions, or trends, or at least identify particularly important questions that must still be answered.

To do this, you will probably find yourself focusing on the subset of your pile, papers which are neither too superficial nor too esoteric. But don’t expect all such papers to agree, especially if you are researching a nano health and safety topic. Consensus comes very slowly in medical and biological research (often only after decades of research and dozens of studies provide enough data to be statistically undeniable).

But this is where your judgment and talents come into play: Analysts, analyze! You don’t have to be 100% sure of your conclusions (as long as you honestly represent your degree of certainty or uncertainty).

MY SPECIFIC EXPECTATIONS FOR THE EXAM:
From you I expect a typed report of your investigations (not a highly polished document already suitable for publication, but a document you would not hesitate to submit to your future boss!). This should identify which nanoscience issue you chose to explore, why you chose it, and what you learned. That paper should also include clear explanations and identification of your deeper sources of information.

If this were a normal final exam you’d spend perhaps a half dozen hours studying and another three hours in the exam. So a report representing an intense full day’s work would be appropriate. Need something more specific? OK, I’d be very disappointed with a 3-5 page report. Something in the 7-10 single-spaced page range would be more plausible. Remember that in addition to a paper copy of your paper delivered to my office, that I also want an electronic copy of it, as well pdfs of the 2-3 research papers you found most informative deposited in your UVA Collab Drop Box for the class.

Bear in mind: I am asking you to educate yourself on an issue that may already be affecting your environment, safety or health!