NENG 612
Nuclear Engineering Laboratory
Research Project

The research project is intended to be a "mini-thesis" that takes you through the full research process on a smaller scoped project that can be relevant to your thesis research. The research project must be related to detection, but does not have to directly leverage the specific concepts covered in this course. It is the intention that the course project could, with very little work, be submitted to a conference or potentially a journal.

There are six primary components to the research project, each of which will be graded separately:

1. Research Plan
2. Research Presentation
3. Lab Notebook
4. Lab Procedures
5. Draft Article
6. Final Article

Each of the components, along with the rubric, is described in further detail below.

Research Plan

The research plan is where you have the opportunity to get course corrections that can avoid major heartache later on. If insufficient detail is provided, then it is difficult to identify where you will run into trouble with physics, logistics, or safety concerns that can delay or completely foil your experiment. When running at an experimental facility, these plans are required to get experimental time, and an example for Ohio State University's reactor is provided along with a more generic example compiled from plans required at different facilities.

Category	**Possible Points**	**Earned Points**
Purpose and logistics	10	8
Description of the experiment	25	23
Safety analysis	25	25
Correct grammar and spelling	10	10
Total	70	66

Research Presentation

The goal of the research presentation is twofold. The primary goal is to describe your research plan, what you have done, and what you plan on doing to a "critical" audience – i.e. think of this as a "mini-prospectus". In addition to providing the plan to the audience, a well constructed update will solicit feedback that can be used to improve the overall research.

The secondary goal is to "educate" the class on an unique aspect of your research. This can be describing a specific detector, concept, data processing technique, etc. This should comprise a little less than half of your presentation.

Category	Possible Points	Earned Points
Topic motivation is clear	10	10
Research plan is appropriately scoped and accounts for key milestones	15	14
Explanation of work is understandable, correct, and supports the motivation	15	15
Concept described correctly and thoroughly	15	15
Concept described at appropriate level for audience	10	10
Good presentation skills: eye contact, volume, clarity of slides, etc.	10	10
Appropriate presentation length	5	4
Total	80	78

NOTES:

- Great job answering questions
- Need to verify peak counts? Take one rx and run through the corrections to demonstrate accuracy in the results you have and practice doing it.
- Great background research and understanding of the problem
- You seemed very confident and comfortable talking and adjusting on the fly.
- In general, scope down your presentations. You have a ton of good information, but generally more that you have time for. Quality over quantity - decide which points you really want to make.
- An important point that you missed to make - research plans go awry; what is you backup? You always want to have a pivot option, explicitly stated, in case things go wrong.

Lab Notebook

Your project will be graded on the documentation of the research. Assume someone is going to follow you on this project; the totality of your project should be able to be understood and reproduced from the the details provided in each component of this research without any additional input from you, the author.

This is nominally done through the lab notebook and the documentation of your procedures and data. However, this is often not sufficient as the processing of the data taken is just as important as the process used to take the data. Therefore, all of this needs to be documented as well. I recommend a GitHub Repo combined with a paper notebook, but you can follow any of the practices outlined below. Your "lab notebook" will be graded on your implementation of these best practices and the correct application of the chosen methods to your specific project. Since there is no cut and dry "right answer" a brief intro or readme describing the documentation approach is highly recommended.

- Lab Notebooks: `https://wiki.med.umich.edu/download/attachments/1608050/Lab%20Notebook%20Presentation%20-%208-12-2016.pdf?version=1&modificationDate=1471355923000&api=v2`
- Reproducible Research: `https://www.practicereproducibleresearch.org/`
- Hybrid Lab Notebooks: `https://eln.wisc.edu/about-eln/best-practices/`

Category	**Possible Points**	**Earned Points**
Project is clearly documented and notebook is legible	10	
Documentation and notebook follow best practices	30	
Documentation is sufficient to understand and reproduce the research	10	
Total	50	

Lab Procedures

The basic criteria for the lab procedures is that I (or someone else) could pick them up and perform the experiment as you did. The lab procedures for this class or NENG 650 can serve as templates to use for this process, but keep in mind that lab procedure for classes often leave some room for "discovery" and learning. Do not replicate these gaps! In general, more detail is better, and figures or tables of expected results at key points is helpful.

Category	**Possible Points**	**Earned Points**
Lab objectives are included	10	
Procedures are explicit and clear	25	
Equipment required is described	10	
Visualizations added as needed	5	
Correct grammar and spelling	10	
Total	60	

Draft/Final Article

The final article should be ∼4-6 pages and no longer than 8 pages (journals have page limits too). This may vary based on the specific project; please use your best judgment. Please include these items as clearly labeled sections in the final article:

1. **Introduction:** What are you trying to accomplish and why? Also preview what you are going to talk about.
2. **Problem Description:** Describe the problem you are solving in this work and explain how it will help you find out the thing you told us about in the introduction.
3. **Description of Work:** What did you do to perform your analysis? This can include any models you built, data you collected, strategies you needed for evaluation, etc.
4. **Results:** What did you find out?
5. **Conclusions:** What do your findings mean? How does that relate to the goal you laid out in the introduction?
6. **References:** You should have references that you cite in your paper; it is highly likely that you are not building upon the previous research of others!

In the draft article please replace "Conclusions" with **Plans for Completion** and keep in mind that "Results" will be preliminary or possibly empty. The first three sections don't have to be completely polished, but they should at least be very solid drafts. The better they are when I read them the more useful the feedback will be.

Notes for writing papers properly:

- If you include figures, use a Figure number and caption; refer to the figure from within the text according to the IEEE style guide.
- You may need to number equations and refer to them in the text.
- *Use section headings for the requested sections.*
- In the introduction, discuss what is coming up in the paper.
- In the conclusions, discuss what you told us in the paper.
- If you talk about a code (that you didn't write yourself), you need to include a reference for that code.
- For the final report, it's a good idea to include enough information for the work to be reproducible. To avoid making the report filled with mundane details you can put some items in an appendix or repository that you reference. Code documentation also serves this purpose.
- Common grammar errors: that vs. which, use vs. utilize, due to vs. because of.

I will use the following rubric for evaluating the paper:

Category	**Possible Points**	**Earned Points**
Correct Approach taken and clearly described	20	
Work correctly implements approach	15	
Goal, problem solved, and analysis conducted have an appropriate logical flow	15	
Conclusions are supported by the results	15	
Complete sentences; correct grammar and spelling	15	
Tables and Figures follow best practices, are clear, and accurately present the data	10	
Sources properly documented following IEEE format	10	
Total	100	