

ME 552 Term Project Part 2
Design and Analysis of Experimental Arrangement
Presentations will be on Friday February 10th at 8 or 10 am
Reports are due February 10th to Rogers 314 by 4 pm (slide under door if needed)

Your team needs to submit a report and present details of the design for your experimental arrangement. The goal is to provide you with experience in designing experiments, considering the uncertainty of your experiments, evaluating how your system interfaces with a data acquisition system or computer, and consider how to improve the system. As engineers it is easy to want to by-pass this step, but careful planning can reduce costs and avoid hours of trying to correct poorly thought out experiments and approaches (as I have done at times). Moreover, you will have an estimate of uncertainties and determine if it will be acceptable *prior* to investing resources. Please note that if you are using an existing experimental arrangement you will need to design your own system and specify your own components for full credit. This will provide you with a better learning experience.

Your report must include the following:

- a) A summary of the objective(s) of your project and a summary of the data which you need to collect.
- b) Plumbing and instrumentation diagram(s). Describe or list each component (e.g., type and model of thermocouples, pressure transducers, etc.). Consider all components needed, including those for your primary measurements (e.g., pressure measurements for an orifice flow meter). An example of a plumbing and instrumentation diagram is posted on Canvas (see DAQ and instrumentation module). Your diagram can be handwritten. **Be sure to explain how the instrumentation that you propose can be used to help satisfy your research objective.** Be sure to include necessary equations, post-processing steps, etc.
- c) A diagram showing how the signal from your instrument interfaces with a data acquisition system. Be sure to consider components within your data acquisition system (e.g., amplifier, cold temperature junction, etc.). An example is provided in Canvas (see the document Illustration of design of DAQ and Uncertainty Analysis.pdf in the uncertainty module).
- d) Propose acceptable/target uncertainty values for your measurements and provide justification.
- e) Perform a design stage uncertainty analysis for your measurements. Include supporting documentation (e.g. instrument uncertainties), equations used and uncertainty trees. Be sure to consider the uncertainty associated with your data acquisition, including amplifiers, etc. An example has been posted on Canvas in the Modules section.
- f) Describe your largest sources of uncertainty and how these could be improved if you had enough time or resources.
- g) Provide a step by step list of operating protocol for starting your experiment and shutting it down. Consider safety implications and include these in your report.

Your presentation should be no more than 20 minutes with an additional 5 minutes for questions and answers. The presentation should include the information listed for your report **as well as** safety procedures for conducting your experiments safely.

The grading matrix is shown below. The presentation and report will be weighted evenly.

Content	Percentage of grade
Professional (grammar, punctuation, spelling, etc.)	15
Summary of experiments, explanation of required data	10
Professional and complete plumbing and instrumentation diagram	15
Design of data acquisition system	15
Describe acceptable uncertainty	5
Design stage uncertainty	15
Describe how to improve uncertainty	10
Design is clearly conveyed	15