# MEEG333 Fluids Laboratory

Fall 2016

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INSTRUCTOR
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330 Spencer Lab
Office Hours: M-Tu-Wed-Th

TA's

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## Objectives

- To illustrate physical concepts of Fluid Mechanics (MEEG331) Lecture
- To learn basic experimental methods for fluid systems.
- To utilize experimental results as a basis for practical design.
- To develop the ability for teamwork.
- To develop effective communication of technical information.
- To develop computer skills for acquiring data, data reduction, error analysis, and presentation of results.

## Experiments

Students working in teams will study a total of six experimental problems (once every other week for an individual) during the semester. Each team will acquire a common set of data for a particular experiment, and each team will submit a single report.

Students must study the lab Instructions thoroughly before arriving at the lab session. The TA's job is not to do the experiment for you. Instead, the TA will familiarize you with the equipment and software. You will need to decide for yourself how best to collect the data to answer the questions posed in the handout. Of course some hints will be provided to get you on your way. The TA will use his/her judgment to determine at what point a group is ready to proceed on its own.

Experiments will be performed in Spencer 123.

**List of experiments:**

X1 Hydrostatic Pressure
X2 Fluid Flow Measurement Devices
X3 Impact Force of a Jet of Fluid
X4 Orifices and Free Jet Flow
X5 Reynolds Experiment
X6 Flow-Delta P in a Circular Pipe

Instructions for each lab can be obtained at www.Udel.edu/sakai

Students will be assigned to a team. Your team will meet approximately every other week at the lab time for which the student enrolled. The detailed schedule for team lab dates and corresponding experiment will be posted.

## Lab Report

Each team will turn in a single report for each experiment, with all team members receiving the same grade. Assume the point of view that you are reporting experimental and analytical results to your employer or client, who will use the information to design a new product, or to more effectively operate a plant or business.

Reports must be printed hardcopy. Reports should be concise, but complete. More than about five pages (excluding cover page & appended data sheets) is getting long. Use your own words; verbatim copying of the lab instructions should be avoided, with exception of the Objectives. Do not pad the length of a report unnecessarily. I grade on merit and content, not weight.

The following outline is general. While all items should be included, you may vary the order and details, always keeping in mind the goal of communicating important results simply and clearly. While not omitting, tedious details may be placed in appendices.

- Title Page
  Title of Experiment
  GroupID e.g., Section 20L Team A1
  Names of group members and role in this experiment
  Date experiment was performed
  Date report submitted
- Objectives (will be provided in lab handout)
- Summary
  Very briefly summarize results, corresponding to the Design Objectives, as if reporting to an employer. Tip: Write this item last, as a summary of your conclusions.
- Theoretical background
  What principle(s) underlie this experiment, e.g., Fluid statics, Bernoulli's law, conservation of momentum…
  Relevant equations – usually the one used to reduce the data

You should not copy or paraphrase the lengthy Theory section of the lab instructions.

- Equipment
  Include a neat schematic diagram with all parts labeled and dimensioned. (**Photographs are an acceptable alternate, provided they are captioned and key parts labeled**).
  Show or describe measurement devices and instruments
  Copying sections of another report or sharing sketches with other groups is **not** permitted.
  Define of all symbols used, including dimensional units.
- Procedure
  For each objective in a given experiment:
    Procedure
    Parameters varied and range of variation
  Again, do not copy lab instructions. Use your own words and shorten.
- Results
  Key data should be rearranged in tabular form. A completely worked-out sample calculation is required for repetitive calculations.
  Use MS Excel, MathCad (or any other spreadsheet program) for tabulation and plotting graphs.
  All graphs must have a caption (what is it?), axes must be labeled, and symbols defined.
- Uncertainty analysis as specified in the lab instructions.
  Suggest ways to reduce uncertainty in the final result.
- Discussion
  Did the apparatus deliver the results intended.
  What discrepancies did you see between theory and experiment?
  If the apparatus malfunctioned or is suspect, say so.
  Is the data reliable enough for a client to base new design or plant operations on it?
  What could be done to improve or increase confidence in the results?

- Conclusions (separate from Discussion)
  Here you present the specific results (data and/or calculations using the data). Give the imagined client your answers to questions.
- Answer the Design Objective Question
- Appendices
  At a minimum this should be your raw (handwritten) data sheets.
  It could also be intermediate tables of calculations that would clutter your main report.

## Ethical Behavior

Please read and understand the Office of Judicial Affairs Quick Reference Guide to Academic Integrity http://www.udel.edu/judicialaffairs/ai.html

In particular, please pay close attention to PROACTIVE STRATEGIES FOR STUDENTS http://www.udel.edu/judicialaffairs/ai.html#stustrat and ABOUT THE INTERNET http://www.udel.edu/judicialaffairs/ai.html#internet . These documents will help you to overcome any misunderstandings of what constitutes unethical behavior. The proper and ethical use of external resources such as the internet is also clearly defined.

## Lab Strategy

Time in the lab is limited and will pass quickly. Before arriving at the lab session, students must study the lab handout and be familiar with the phenomena they will investigate and the procedure to do so. Such preparation will make for smoother and more fruitful lab experience.

At the beginning of the lab each team will be asked to sign up for responsibility for the lab work and report. This is a personal commitment to your fellow team members. Agreeing up front will make the whole process easier. Roles may be team leader, data recorder(s), analyst(s), sections of the report, etc. It is intended that roles be varied for each experiment, so that everyone tries every task. In the report, INITIAL the part(s) you did. More than one person can work on a section, particularly if calculations required.

A key outcome of the pre-lab preparation is an experimental **data-sheet** listing all of the quantities that will be measured (and how many times) for each experiment objective. The row and column headings will prove that adequate thought has gone into planning the experimental procedure. Please obtain the **TA's signature** on this data-sheet when work is completed. The TA may conduct a short quiz before the experiment to measure your level of preparedness.

## Grading of Reports

Fulfilling the formatting requirements listed above (All sections included, neatness, professionalism, and on-time reporting are key) will fetch you an automatic 5 points on a scale on a scale of 10. The remaining points will be awarded on the basis of merit including the organization of thoughts, correct computations, excellence of analysis, and response to Design Objectives.

Lab reports are due no later than **two weeks** after performing the experiment, approximately on or before the next experiment for the particular team. Late reports will be penalized, 0.5 points for every late day. Lab attendance is absolutely necessary. An

unexcused absence will cause a deduction of 0.5 points from the lab report (for the absent individual, not the team). Grading concerns should be addressed to the TA's.

## Evaluation

Lab report grades for each team will be averaged with an individual's grade on the final quiz.. Course grade will be based on the average according the following schedule:

| | |
|---|---|
| 93+ | A |
| 90 | A- |
| 87 | B+ |
| 83 | B |
| 80 | B- |
| 77 | C+ |
| 73 | C |
| 70 | C- |
| 67 | D+ |
| 63 | D |
| 60 | D- |
| <60 | F |

Generally, all members of the team will receive the same report grade. Exceptions may occur because of an unexcused absence, not contributing to report, attendance at Wed Discussion lectures, etc.

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