**Lecture:** MWF 08:00-08:50a – Blended Class (In-class (8wks) and **Online (7wks)**)

**Location:** 10 Sparks


Hard copy: PSU Bookstore

Non-expiring eCopy: [https://store.vitalsource.com/digital-textbooks](https://store.vitalsource.com/digital-textbooks) [Search: “Munson”]

**Instructor:** Derek Elsworth - 231 Hosler – elsworth@psu.edu [http://www.ems.psu.edu/~elsworth/]

**TAs:**
Sheng Zhi – suz140@psu.edu – Coordinating TA (By Appointment) – 230A Hosler

**Office Hours** – 111 Hosler (EME Study Room)

Nick Buczacki – nzb5221@psu.edu – M/Th 1:30-4:30 & Tu/Fr 1:30-3:30

Corey Hoydic – cjh5690@psu.edu – M/W 10:15-2:15 & Tu/Th 12:00-1:00

**Online Resources:** [Class resource page:](http://www.ems.psu.edu/~elsworth/courses/eme_303/)

**Prerequisites:** MATH 250 or MATH 251 and PHYS 212

**Grading:**

- Weekly Assignments ~13 equally weighted 15%
- Group Presentation Assignment 10%
- Mid-Term Exams (3 @ 15% each) 45%
- Final Exam 30%
- Online content quizzes (~7x @ 0.33% each) ~7%

**100%**

**Format:** There are three deliverables for this class: (i) weekly assignments [15%], preparation then delivery of a group presentation [10%], and four exams [75%]. And an opportunity for extra-credit content quizzes [~7%].

**Weekly assignments** are typically due on the subsequent Thursday at midnight – the topics of week 1 are due on Thursday of week 2, etc. Assignment questions are posted on [canvas.psu.edu](https://canvas.psu.edu). Assignment answers are submitted online on [canvas.psu.edu](https://canvas.psu.edu) with three attempts and correct/incorrect feedback. Students may work together but must submit their own work. These deadlines are firm (i.e. no retroactive credit) and students are responsible to check that their score is correctly recorded.

**Group presentation assignments** allow students to explore and report on some interesting or mysterious aspect of fluid mechanics – typically to use a video clip to represent an intriguing observation, to provide an explanation of the phenomenon and to complete a simple analysis of the system (see examples on “Class resource page”).

**Mid-term exams** are scheduled for the evenings on S20, O18, N08 (8pm-midnight). Questions reflect Assignment questions, topics and questions discussed in class and also material in the combined course notes package. See prior exams for worked examples (on [canvas.psu.edu](https://canvas.psu.edu)). Conflict exams are granted only in exceptional circumstances and must be requested at least 1-week in advance.

**Final exam** is comprehensive and is as-scheduled in exam week. Any conflict exam must be scheduled through the University system.

All exams are closed book and closed notes but students may prepare and bring a two-sided letter-sized equation/note sheet and a calculator. Full credit for questions is based both on shown-working and the final answer. Disputes of exam grades must be initiated with the TA within 1-week of the returned exams.
Grades: **Final Grades** are based on the following divisions using raw (uncurved) scores:

- **A** (>93.3%); **A-** (>90.0%)
- **B+** (>86.6%); **B** (>83.3%); **B-** (>80.0%)
- **C+** (>75.0%); **C** (>70.0%)
- **D** (>60.0%); **F** (<60.0%)

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<th>Topic</th>
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<th>Reading Assignment</th>
<th>Assignments (7e)</th>
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<tr>
<td>[1]</td>
<td>Orientation, Fluid Properties</td>
<td>Chapter 1: Appendices B and C</td>
<td>[Hw 1] Chapter 1: 1, 5, 13, 25, 41, 45, 51, 55, 79, 93, 97, 119, 123</td>
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<td>[3]</td>
<td>Pressure forces on plane and curved surfaces, buoyancy, floatation and stability</td>
<td>Chapter 2: Sections 2.8 – 2.12</td>
<td>[Hw 3] Chapter 2: 75, 79, 85, 93, 113, 137, 143, 151</td>
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<td>[4]</td>
<td>Elementary fluid dynamics, Bernoulli Equation</td>
<td>Chapter 3</td>
<td>[Hw 4] Chapter 3: 5, 12, 21, 27</td>
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<td>[5]</td>
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**Final Examination of Parts I-IV**
Academic Conduct:

Penn State’s policy on academic integrity applies to all aspects of course deliverables. Students are encouraged to work together on all assignments but must submit independent work for all graded deliverables. Further details are available at: https://handbook.psu.edu/content/academic-integrity

Per AD 42-27 [https://handbook.psu.edu/content/class-attendance] class attendance for this course is encouraged. “A student should attend every class for which the student is scheduled and should be held responsible for all work covered in the courses taken.” Absence from exams should be appropriately corroborated (e.g. doctor’s note, etc.).

Fall 2017 EME 303 Calendar – At-a-Glance [In-class/Online]

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<td>Mid-term exam (90 minutes – 8pm-midnight)</td>
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EME 303 - FLUID MECHANICS IN ENERGY AND MINERAL ENGINEERING

GROUP PRESENTATION RUBRIC

One of the deliverables for the course will be a group presentation. This is to (i) encourage you to think critically and creatively about the role of fluids in the world around you, (ii) sharpen your skills of analysis, and (iii) to communicate and share your findings with an audience. Think of it as SpeechCom 100/EMSc 100 with quantification.

The ground rules for this are as follows:

Students will work in small groups to develop a powerpoint presentation to identify and investigate a curious observation in fluid mechanics and develop an appropriate analysis of the process. Examples of such a presentation will be given early in the course to guide the development of the presentation.

The presentation can be a single but dense slide and should last for 3 minutes. It should be interesting/compelling/enigmatic rather than lengthy.

The best presentations will include:

1. **Observation [30%]** Pick an interesting observation – this will typically be interesting because it is not immediately apparent to the lay observer why the behavior is so – i.e. there is an element of mystery. This is the *what* of the observation.
   Native videos, links to YouTube or other online resources or photographs or diagrams are the best option.

2. **Explanation/Hypothesis [30%]** Provide an appropriate explanation – this will describe the mechanics of the observation – why it behaves the way it does. The explanation could advance an hypothesis or competing hypotheses. At the minimum it should describe the mechanism in enough detail to be self contained.
   Identify the points in bullet form and describe them verbally to your audience.

3. **Analysis [30%]** Provide an appropriate analysis of the mechanism(s) – this should describe the process based on the principles of mechanics – fluid mechanics.
   Be as rigorous in your analysis and as quantitative as possible.

4. **Conclusion [10%]** An appropriate Conclusion – this should confirm the mechanism through the appropriate analysis.

**Deadlines:**

Teams will be assigned: Wednesday of Week 3
First meeting and group meeting: Wednesday of Week 5
Provide topic: Wednesday of Week 7
Confirmation of topic: Wednesday of Week 8 [to ensure no duplication]
Upload presentation file: Sunday midnight before presentation week (13)
Presentation: As scheduled (week 13) on YouTube with peer review

**Grading:**

To be based on final presentation only and peer review of ~5-10 other presentations. Grades to be uniformly distributed in quartiles between 100 (upper), 95 (lower-upper), 90 (upper-lower), 85 (lower) except no-shows and deficient presentations.

Peer-review evaluations within groups will be incorporated.
Some Random But Potential Topics – To Get You Thinking

Natural Processes
What drives atmospheric flows? How fast can the atmosphere flow?
What controls the fluid circulation in the oceans? Is there a limiting magnitude of velocities of currents?
Which of pressure-driven or density-driven currents are likely to be faster?
How does the sediment capacity of rivers change with flow velocity – if you double the velocity what happens to the sediment carrying capacity?
How much blood does a human heart have to pump to keep us alive? Can you estimate the minimum overpressure and the likely flow rate?
What controls the circulation of the tectonic plates on the planet?
When a droplet of water impacts a surface, what comprises the rebound drop? Is it the original drop?
What is the analog with a bouncing ball?

Engineered Systems
BP oil spill – how does PIV work and what corrections need to be applied? How do you separate out liquid and gas fractions to give estimates of flows? How does a bottom kill work? Will the gas or oil reach the surface first? How long will this take and what are the important factors?
What fraction of its intrinsic energy is used in transporting natural gas from the Gulf of Mexico to New York? How is this affected by the diameter of the pipe? How does this scale with pipe cost?
What is the limiting lift of a suction pump, and why? What are methods of exceeding this lift limitation?
Is it really best to leave your windows open in a tornado? Why?
Why do you sometimes see a vapor streak above the wing on high-lift passenger planes? What are the necessary atmospheric and take-off velocity conditions for this?
How fast can you accelerate before your drink overtops its glass and spills? What are the processes in action?

Recreation
Why does a spinning baseball curve? How much spin will give how much curve?
Is spin imparted to a tennis ball glancing the ground? And if so how much?
How can kayakers stay static in whitewater rivers without paddling? What are the conditions necessary to achieve this?
How do yacht sails work? How close into the wind can you sail and what is the limitation? Do airfoils work better than flexible sails?
Why is a long hull faster than a short hull?
How do whole body competitive swim suits work? How much faster to they make it possible to go versus bare skin, and why? And why are golf balls dimpled?
Why does rifling in a barrel and spinning a thrown football help accuracy?
What is terminal velocity and how does it vary for different sized objects? Will a child freefall skydiver fall faster or slower than an adult skydiver?
If you are skiing/snowboarding, is it better to be a child or an adult if you want to go as fast as possible on a given slope?
What happens when Mentos go into Coke? How high can it foam and for how long? How fast can the bottle travel and what is its time history? What is the analog with volcanic eruptions?