

## EME 303- FLUID MECHANICS IN ENERGY AND MINERAL ENGINEERING

- Lecture:** MWF (1) 10:10-11:00a (2) 11:15-12:05
- Location:** (1) 162 Willard Building (2) 129 Waring Commons
- Text:** *Fundamentals of Fluid Mechanics*, Munson, B.R., Young, D.F., Okiishi, T.H. and Huebsch, W.W. Sixth Edition, John Wiley & Sons, Inc., 2009.
- Instructor:** Derek Elsworth - 231 Hosler – [elsworth@psu.edu](mailto:elsworth@psu.edu)
- TA:** Nithiwat Siripatrachai – 216 Hosler – [nxs298@psu.edu](mailto:nxs298@psu.edu)  
M 2-6p; W 4-8p – EME Study Room  
Bahareh Nojabaei – 159 Hosler - [nojabaei@psu.edu](mailto:nojabaei@psu.edu)  
Tu 2-6p; Th 4-8p – 126A Hosler
- 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%         |
|   | <b>100%</b> |
- Format:** Weekly assignments are due on subsequent Wednesdays for **odd-numbered questions** and are to be completed online. Students *may* work together but *must* submit their own work. Students are responsible to check that their score is correctly recorded on Angel within one week of submission (i.e. no retroactive credit).
- Group assignments are to explore and report on some aspect of fluid mechanics – to use a video to represent the observation, to provide an explanation of the phenomenon and to complete a simple analysis of the system (see example in first class).
- These groups will identify a YouTube contribution relevant to the class material of that day – once per semester on a roster TBD.
- Mid-term exams are completed in the evenings on S19, O19, N16. Mid-term questions will reflect Assignment questions, topics and questions discussed in class and material in the printed notes.
- Final is comprehensive and is as-scheduled in exam week.
- All exams are closed book and closed notes but students may prepare and bring a two-sided letter-sized equation/note sheet.
- Grades:** **Grades** are based on the following divisions:  
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%)

Topic	Subject	Reading Assignment	Assignments – Odd numbered	Week
[1]	Orientation, Fluid Properties	Chapter 1: Appendices B and C	[Hw 1] Chapter 1: 2, 6, 16, 20, 26, 40, 46, 60, 76, 94; <b>7, 17, 25, 41, 45, 55, 63, 79, 99</b>	1
[2]	Fluid statics	Chapter 2: Sections 2.1 – 2.7	[Hw 2] Chapter 2: 2, 8, 16, 20, 38, 46; <b>5, 15, 21, 27, 41</b>	2
[3]	Pressure forces on plane and curved surfaces, buoyancy, floatation and stability	Chapter 2: Sections 2.8 – 2.12	[Hw 3] Chapter 2: 52, 64, 70, 84, 98, 110; <b>53, 65, 71, 85, 97, 103</b>	3
<b>Mid-Term I</b>				<b>S19</b>
[4-5]	Elementary fluid dynamics, Bernoulli Equation	Chapter 3	[Hw 4-5] Chapter 3: 8, 24, 38, 60, 72, 84, 98, 106; <b>13, 23, 37, 51, 73, 85, 111</b>	4-5
[6]	Control volumes. Reynolds transport Theorem	Chapter 4: Sections 4.1-4.4	[Hw 6] Chapter 4: 10, 22, 28, 42, 54, 60; <b>15, 23, 37, 51</b>	6
[6]	Conservation of Mass and Continuity Equation	Chapter 5: Section 5.1	[Hw 6] Chapter 5: 6, 10, 12, 18, 26, 32; <b>7, 15, 21, 29</b>	6
[7]	Newton's Second Law. Conservation of linear momentum	Chapter 5: Section 5.2	[Hw 7] Chapter 5: 38, 44, 48, 60, 76, 80; <b>39, 45, 53, 69, 81</b>	7
<b>Mid-Term II</b>				<b>O19</b>
[8]	First Law of Thermodynamics. Energy equation	Chapter 5: Section 5.3 Chapter 6: 6.1-6.2, 6.8	[Hw 8] Chapter 5: 92, 102, 110, 126; <b>93, 107, 115</b> Chapter 6: 8, 18, 82; <b>9, 45, 79</b>	9
[9]	Similitude. Dimensional analysis. <i>Pi</i> Theorem. Modeling.	Chapter 7:	[Hw 9] Chapter 7: 2, 8, 16, 26, 40, 58, 68, 78; <b>3, 11, 33, 71</b>	10
[10-11]	Viscous flow in pipes. Laminar -vs- turbulent. Head losses, Moody Diagrams	Chapter 8: Sections 8.1 - 8.4.1	[Hw 10] Chapter 8: 4, 8, 22, 32, 38, 44; <b>5, 13, 25, 33, 45</b>	11
[10-11]	Viscous flow in pipes, exit/entry & minor losses. Flow calculations. Flow measurement	Chapter 8: Sections 8.4.2 - 8.6	[Hw 11] Chapter 8: 58, 62, 64, 74, 86, 94, 102, 110, 118; <b>61, 69, 73, 83, 95, 111</b>	12
<b>Mid-Term III</b>				<b>N16</b>
[12]	Flow over immersed bodies. Boundary layer concepts. Drag and Lift	Chapter 9	[Hw 12] Chapter 9: 6, 14, 22, 38, 54, 66, 80, 94, 101; <b>15, 37, 51, 71, 95</b>	13
[13-14]	Open channel flow. Wave hydraulics. Specific Energy & Momentum.	Chapter 10 10.1 – 10.7	[Hw 13] Chapter 10: 4, 8, 12, 18, 28; <b>3, 13, 19, 29</b>	14
[13-14]	Uniform flow. Chezy and Manning concepts	Chapter 10 10.4	[Hw 14] Chapter 10: 36, 42, 54, 64, 74, 84; <b>39, 45, 59, 73</b>	15
<b>Final Examination of Parts I-IV</b>				<b>16</b>

### Academic Conduct:

Penn State's policy on academic integrity applies to all aspects of course deliverables. Students are encouraged to work together on practice assignments. Students must submit independent work for all graded deliverables. Further details are available at: [www.ems.psu.edu/students/integrity/index.html](http://www.ems.psu.edu/students/integrity/index.html)

**Fall 2011 EME 303 Calendar - At-a-Glance**

**August 2011**

Su	Mo	Tu	We	Th	Fr	Sa	Wk	Topic
21	22	23	24	25	26	27	1	[1] Fluid properties
28	29	30	31				2	[2] Fluid Statics

**September 2011**

Su	Mo	Tu	We	Th	Fr	Sa	Wk	Topic
				1	2	3		
4	5	6	7	8	9	10	3	[3] Fluid Pressures, Buoyancy
11	12	13	14	15	16	17	4	[4-5] Fluid Dynamics
18	19	20	21	22	23	24	5	[4-5] Fluid Dynamics
25	26	27	28	29	30		6	[6] Control Volumes

**October 2011**

Su	Mo	Tu	We	Th	Fr	Sa	Wk	Topic
						1		
2	3	4	5	6	7	8	7	[7] Newton's Law and Conserv. of Momentum
9	10	11	12	13	14	15	8	[8] Thermodynamics and Energy
16	17	18	19	20	21	22	9	[9] Dimensional Analysis
23	24	25	26	27	28	29	10	[10-11] Flow in Pipes - Moody
30	31							

**November 2011**

Su	Mo	Tu	We	Th	Fr	Sa	Wk	Topic
		1	2	3	4	5	11	[10-11] Flow in pipes - Networks
6	7	8	9	10	11	12	12	[12] External Flows
13	14	15	16	17	18	19	13	Present Group Assignments
<del>20</del>	<del>21</del>	<del>22</del>	<del>23</del>	<del>24</del>	<del>25</del>	<del>26</del>		
27	28	29	30				14	[13] Open Channel Flow/Review

**December 2011**

Su	Mo	Tu	We	Th	Fr	Sa	Wk	Topic
				1	2	3		
4	5	6	7	8	9	10	15	Present Group Assignments
11	12	13	14	15	16	17		Final - as scheduled
18	19	20	21	22	23	24		
25	26	27	28	29	30	31		