COURSE: Fluid Mechanics EN-4111
SEMESTER: Fall 2022
ROOM: **TBD**
TIME : 1200 - 1250 M, W, F

INSTRUCTOR: Pete Carroll, P.E.
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ACADEMICS & LEADERSHIP: This class will focus on the basics of fluid mechanics as well as delve into some fluid dynamics. In addition to the technical theory behind fluids, I have a high expectations for the display of leadership, character, morals, ethics and respect. This is in regard to one another and between you and I. I expect all students to be on-time to classes and take notes. I expect all of you to pay attention to the lecture through eye contact and engaged with insightful questions. This will be a fast-paced, rigorous course and will require your understanding of the homework, quizzes, in class exercises and readings, in order to do well on the tests. Attitude is everything.

PRACTICAL EXERCISES: Some classes will begin with a practical problem for you to try and individually solve. I will give you hints to think about and methods to use to try and reach the answer.

TEXT: Fluid Mechanics, **9th Edition** by Frank M. White, McGraw Hill. We will be using the 'e-text' as it is a more affordable option. All homework will be in a format discussed on the first day of class. It is required you purchase this e-book. The link to purchase this text is https://www.mheducation.com/highered/product/fluid-mechanics-white/M9781260258318.html Hard cover texts, both used and rental are also available through the bookstore and I would highly recommend this route instead of an e-book, but the choice is yours.

OFFICE HOURS: 1000 – 1050 AM - M, W, F.

ATTENDANCE POLICY: You are expected to provide advance notice and rationale for any absence; 4% will be deducted from your final grade for each unexcused absence. For excused absences, a legitimate excuse needs to be provided by text, phone or email before the beginning of class. There will be no make-up for unexcused absences during an exam or quiz. You are responsible for ensuring your attendance is counted if you arrive late and you must make a copy of a binnacle sheet (if sick) and e-mail it to me. Sports participation, sickness (with binnacle sheet), or death in immediate family are excused. Bad traffic, car won't start, oversleeping and excessive lateness are all, but not totally inclusive of unexcused absences; however, some cases not listed may be considered excused. In short, plan on attending ALL classes.

READ-AHEAD POLICY: Completion of all read-ahead and homework problem assignments is required. You are to be prepared for class by reading the assigned topics in the textbook, lecture notes or other sources on the assigned lecture topic before coming to class. You are expected to be able to present your understanding of read-ahead material in class when requested.

HOMEWORK POLICY: Please refer to the homework and test schedule for due dates. Homework will be turned in on engineering graph paper without exception. The format of homework will be reviewed in class.

TECHNOLOGY POLICY: You should bring a calculator to each class, as we will be doing real-time problem solving in each class period. You may use scientific calculators for exams.

FOOD & DRINK POLCY: Small snacks and drinks are allowed if trash and cleanliness doesn't become a problem.

GRADING POLICY: Four, 50 minute exams (15% each), homework (20 % total), and 'participation' (20%). Participation is a function of both attendance and asking questions during class. All engineering courses are analytical in nature, therefore to get full credit for any problem done, work must be shown and answers boxed.

Letter Grade Cut-Offs:

93 ≤ X ≤ 100	A	77 ≤ X ≤ 79	C+
90 ≤ X ≤ 92	A−	73 ≤ X ≤ 76	C
87 ≤ X ≤ 90	B+	70 ≤ X ≤ 72	C−
83 ≤ X ≤ 86	B	67 ≤ X ≤ 69	D+
80 ≤ X ≤ 82	B−	63 ≤ X ≤ 66	D
		X < 63	F

There will be no D- grades given. **You must have an average ≥ 63 in order to pass this class.**

The Academy offers, upon request, accommodations to students with documented learning disabilities. The ADA Coordinator, Asst. Dean Elaine Craghead, evaluates the documentation provided, determines appropriate services, and is available to discuss accommodations with students. The Disability Resources office is located in the Academic Resource Center, ABSIC 320. Students can drop in during normal business hours, M-F 0800-1600, or call x5120, or email ADAcompliance@maritime.edu.

STUDENT LEARNING OUTCOMES: The main objective of the course is for the student to learn the underlying theories and principles that govern the analysis and solution of various fundamental engineering problems in BG or SI units dealing with a Newtonian fluid i.e., common liquids and gases. In doing so, the student should enhance their problem solving skills and improve their analytical competency.

At the completion of this course the student should be able to:

- Distinguish various fluid properties and describe their significance
- Calculate the absolute or gage pressure in a fluid at rest (static state)
- Calculate hydrostatic forces on a plane surface
- Calculate weight and buoyant forces of submerged and floating objects
- Apply the Bernoulli Equation to free jets and confined flows
- Apply the Continuity Equation to pipe flow analysis
- Analyze flow rate meters and open channel flow
- Determine if a fluid flow is laminar, turbulent, or transitional
- Use the Moody Chart to determine friction factor
- Calculate major and minor losses in a piping system
- Size a piping system given design parameters
- Determine the length of an entrance region
- Calculate requirements for non-circular conduits
- Analyze boundary layer effect on immersed objects
- Calculate drag and lift forces on a variety of objects
- Analyze centrifugal pumps and their performance
- Size and select a pump type given design parameters
- Calculate net positive suction head (NPSH) and understand its importance

Massachusetts Maritime Academy Department of Engineering

EN4111 – Fluid Mechanics - Fall 2022

Date	Day	Lec.#	Reading	Topic	Homework
7-Sep	W	1	1.1-1.4	Introduction - System of Units	10, 13
9-Sep	F	2	1.6	Thermodynamic Properties of Fluids	25, 26
12-Sep	M	3	1.7	Viscosity, Newtonian Fluids	40, 52
14-Sep	W	4	1.7	Surface Tension, Vapor Pressure	72, 74
16-Sep	F	5	1.7	No-Slip, Speed of Sound	75, 78
19-Sep	M	6	2.1-2.3	Hydrostatic Pressure	9, 10
21-Sep	W	7	2.4	Hydrostatic Applications	20, 39
23-Sep	F	8	3.1-3.3	Control Volume, Conservation of Mass	12
26-Sep	M	9	3.4	Linear Momentum	40
28-Sep	W	10		***EXAM 1***	
30-Sep	F	11/12	3.5	Bernoulli's Equation, Static & Dynamic Pressure	126, 130
3-Oct	M	13	3.7	Steady Flow Energy Equation	175**,** 176
5-Oct	W	14	6.3-6.4	Reynolds Number, Internal Flow	4, 6bd
7-Oct	F	15	6.6	Head Loss, Laminar Flow	10
10-Oct	M			**NO CLASS - Columbus Day**	
11-Oct	Tu	16/17	6.7	Head Loss, Turbulent Flow, Moody Chart (Mon Sked)	45, 52
12-Oct	W	18	6.7	Pipe Flow Problem Types	62, 74
14-Oct	F	19	6.8	Flow in Noncircular Ducts	92b
17-Oct	M	20	6.9	Minor Losses	105
19-Oct	W	21	6.9	Piping Systems, Pump/Turbine Head	110
21-Oct	F	22		***EXAM 2***	
24-Oct	M	23	11.1	Classification of Pumps	8, 11
26-Oct	W	24	11.2	Centrifugal Pumps	12, 14
28-Oct	F	25	11.3	Pump Performance Curves, NPSH	43
31-Oct	M	26	11.5	Pump Selection	73
2-Nov	W	27	11.4	Mixed & Axial Flow, Specific Speed	47, 48a, 54a
4-Nov	F	28	11.6	Turbines, Specific Power	86a, 94
7-Nov	M	29	11.6	Wind Turbines	101, 103
9-Nov	W	30		***EXAM 3***	
11-Nov	F			**NO CLASS - Veteran's Day**	
14-Nov	M	31	2.5	Hydrostatic Force on Planar Surfaces	50, 66 (force & loc.)
16-Nov	W	32	2.8	Buoyancy and Stability	104, Barge, 131
18-Nov	F	33	2.5	External Flow, Flat Plates	16, 31
21-Nov	M	34	7.1, 7.4	External Flow, Drag	70, 76
23-Nov	W			**NO CLASS - Thankgiving**	
25-Nov	F			**NO CLASS - Thanksgiving**	
28-Nov	M	35	7.6	External Flow, Lift	122a
30-Nov	W	36	10.1	Open Channel Flow	2a, 5, 11, 16a, 20
2-Dec	F	37	10.1-10.3	Flow Over Bump, Sluice Gate, Weirs	
5-Dec	M	38		Exam 4 Review	
7-Dec	W	39		***EXAM 4***	
9-Dec	F	40		***Backup Day***	
12-Dec	M	41		***Backup Day***	