Fluid Mechanics EN-4111 Syllabus

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OFFICE HOURS: Tue, Wed, Thu 10-11am, or by appointment. Office hours can be virtual as well; just notify me ahead of time if you would like to meet online at a mutually agreeable time.

TEXT: Fluid Mechanics, 8th Edition by Frank M. White, McGraw Hill. Other editions of this text, or other Fluid Mechanics texts are acceptable for reference and quiz preparations; however, all lectures, in-class exercises and homework problems will be posted to Blackboard. You can procure a hardcopy of the textbook from the bookstore, or optionally procure a copy online (printed or digital).

CLASS FORMAT: Project-based team assignments. Short lectures followed by in-class exercises. You are expected to attend every class on-time and stay until the end; your attendance will be graded. Student participation in class and during project team breakout sessions will be part of your grade.

READ-AHEAD POLICY: You are expected to prepare for class by reading the assigned topics before coming to class, either from the lecture notes (posted to Blackboard) or from the textbook, or from any other sources on the assigned lecture topics. Reading ahead of class will reinforce understanding and retention of course concepts.

TECHNOLOGY POLICY: You should bring paper, pencil and a calculator to each class, as we will be doing real-time problem solving or quizzes in each class period. Mobile phones are to be silenced and stored out of sight during class. You may use a scientific calculator for quizzes. Use of mobile phones, smartphones and laptops are prohibited during quizzes.

ATTENDANCE POLICY: You are expected to provide advance notice and rationale for any absence; **1%** will be deducted from your grade for any excused absence, late arrival, early departure, cell phone use or inattention in class. For an excused absence, a legitimate excuse needs to be provided by text, phone or email well before the beginning of class. For unexcused absences, or for any more than 4 excused absences per semester, **2%** will be deducted from your final grade and you will lose the **5%** attendance bonus. More than 2 unexcused absences will result in immediate **failure** of this course.

HOMEWORK POLICY: Homework is due by the end of the day it is assigned. The homework score is reduced **10%** for each day submitted past the due date. An average of **60%** or greater on the assigned homework is required to pass this course.

QUIZZES: Quizzes based on assigned and recently completed homework or in-class exercises will be implemented periodically to assess your understanding of fluid mechanics principles. You are not allowed to leave your desk during quizzes. If you are absent and not previously excused, you will get zero credit for the quiz. An average of **60%** or greater on quizzes is required to pass this course.

PROJECT POLICY: A significant element of this course will be the completion of **team projects**. You will be required to form into teams of 3 students for each project; the instructor will either assign students to teams or allow students to select their own team. Team roles and responsibilities will be defined by each team. **The completion of all 4 team projects is required to pass this course**. Project descriptions and requirements will be provided at the beginning of each project segment. Project breakout sessions will be conducted during class sessions to assess progress and provide any required guidance. A project report and a brief in-class presentation are required for each project. Each team member will assess the relative contribution of all team members, and this assessment will be part of your individual project grade.

GRADING POLICY: Four team projects (**40% total = 30% Report + 10% Presentation**) plus periodic quizzes (**30%**) and homework (**30%**). All your work must be shown to get full credit for any assignment, homework or quiz, A collaborative and professional learning environment is encouraged, therefore **extra credit** will be applied up to **5%** for **in-class participation**, up to **5%** for **completion of "challenge" homework assignments**, and up to **5%** for **perfect attendance.**

Letter Grade Cut-Offs:

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

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

MMA is committed to providing reasonable accommodations to students with documented disabilities. Students who believe they may need accommodations for this class are required to contact the Director of Disability Compliance, within the first week of class.

STUDENT LEARNING OUTCOMES: Students shall demonstrate the ability to apply the theories and principles dealing with common liquids and gases in BG or SI units. At the completion of this course the student shall be able to:

Define Basic Fluid Properties

1. Distinguish various fluid properties and describe their significance
2. Calculate the absolute or gage pressure in a fluid at rest (static state)
3. Calculate hydrostatic forces on submerged plane surfaces
4. Apply the concept of linear momentum to liquid flow

Analyze Internal Flow Systems

5. Apply the Bernoulli Equation and Continuity Equation to pipe flow analysis
6. Determine if a fluid flow is laminar, turbulent, or transitional
7. Use the Moody Chart to determine pipe friction factor
8. Calculate major and minor losses in a piping system

Specify Turbomachinery

9. Analyze centrifugal pumps and their performance
10. Size and select a pump type given design parameters
11. Calculate net positive suction head (NPSH) and understand its importance
12. Calculate power output of various turbine types

Analyze External Flow Systems

13. Calculate buoyant forces of submerged and floating objects
14. Calculate the stability of floating objects
15. Calculate drag and lift forces on a variety of objects
16. Analyze open channel flow

	Massachusetts Maritime Academy Department of Engineering					*Rev 0*	**Optional**
	EN4111 – Fluid Mechanics - Spring 2025						**"challenge"**
	Date	**Day**	**Lec.#**	**Reading**	**Topic**	**Homework**	**Homework**
					Project 1 Introduction: Recreational Submarine Rescue		
1	5-Mar	W	1	1.1-1.4	**Introduction - System of Units**	ICE- assigned in class	1.21
2	7-Mar	F	6	2.1-2.3	**Hydrostatic Pressure**	2.9ab, L6 ICE	2.20
3	10-Mar	M	33	2.8	**Buoyancy and Stability**	2.104, L33 ICE (barge)	ICE(TSK)
4	12-Mar	W			**Project 1 Status Review**	Lift Bag & Barge Design	
5	14-Mar	F	2	1.6	**Thermodynamic Properties of Fluids**	1.26, L2 ICE	
6	17-Mar	M			**In-Class Project Presentations**	Project 1 Report & Pres.	
7	19-Mar	W			**In-Class Project Presentations**	Team Member Assess.	
					Project 2 Introduction: Hydofoil Water-Jet Ferry		
8	21-Mar	F	3	1.7	**Viscosity, Newtonian Fluids**	1.41, L3 ICE(a)	L3 ICE(b,c)
9	24-Mar	M	35	7.1, 7.4	**External Flow, Flat Plates**	7.31, L35 ICE	L35 ICE
10	26-Mar	W	36	7.6	**External Flow, Drag**	7.65, L36 ICE	L36 ICE
11	28-Mar	F	37	7.6	**External Flow, Lift**	7.122a, L37 ICE	7.122b
12	31-Mar	M			**Project 2 Status Review**	Hydrofoil System Design	
13	2-Apr	W	8	3.1-3.3	**Control Volume, Conservation of Mass**	3.12, L8 ICE	
14	4-Apr	F	9	3.4	**Linear Momentum**	3. 40, 3.43, L9 ICE	3.56
15	7-Apr	M	11	3.5	**Bernoulli's Equation, Static & Dynamic Pressure**	3.130, L11 ICE	
16	9-Apr	W	13	3.7	**Steady Flow Energy Equation**	3.176, L13 ICE	3.172
17	11-Apr	F			**Project 2 Status Review**	Water Jet System Design	
18	14-Apr	M			**In-Class Project Presentations**	Project 2 Report & Pres.	
19	16-Apr	W			**In-Class Project Presentations**	Team Member Assess.	
	18-Apr	F			**NO CLASSES - Presidents Day Holiday**		
	21-Apr	M			**NO CLASSES - Presidents Day Holiday**		
					Project 3 Introduction: Fire Supression System		
20	23-Apr	W	14	6.3-6.4	**Internal Flow, Laminar Flow**	6.4, 6.10, L14 ICE	6.32
21	25-Apr	F	16	6.6	**Head Loss, Turbulent Flow, Moody Chart**	6.52, L16 ICE	6.45
22	28-Apr	M	18	6.7	**Pipe Flow Problem Types**	6.62, L18 ICE	
23	30-Apr	W	20	6.9	**Minor Losses**	6.105, L20 ICE	
24	2-May	F			**Project 3 Status Review**	Piping Layout & Head	
25	5-May	M	23	11.1	**Pump Characteristics**	11.14, L23 ICE	L23 ICE
26	7-May	W	25	11.3	**Pump Performance Curves, NPSH**	11.43, L25 ICE	NPSH ExCr
27	9-May	F	26	11.5	**Pump Selection**	L26 ICE	
28	12-May	M			**Project 3 Status Review**	Pump Selection	
29	14-May	W			**In-Class Project Presentations**	Project 3 Report & Pres.	
30	16-May	F			**In-Class Project Presentations**	Team Member Assess.	
					Project 4 Introduction: Feed a Village		
31	19-May	M	28	11.6	**Turbines**	6.110, L28 ICE	
32	21-May	W	29	11.6	**Wind Turbines**	11.101, 11.103, L29 ICE	11.108
33	23-May	F	30		**Marine Hydrokinetics**	11.94a, L30 ICE	
34	27-May	Tu			**Project 4 Status Review**	Pump and Turbine Power	
35	28-May	W	38	10.1-10.3	**Open Channel Flow**	L38 Handout, L38 ICE	10.20
36	30-May	F	32	2.5	**Hydrostatic Force on Planar Surfaces**	L32 ICE	
37	2-Jun	M			**In-Class Project Presentations**	Project 4 Pres. & Excel	
38	4-Jun	W			**In-Class Project Presentations**	Team Member Assess.	
39	6-Jun	F			**BACKUP DAY - IF NEEDED**		
40	9-Jun	M			**BACKUP DAY - IF NEEDED**		Kayak Video
41	10-Jun	Th			**Finals Commence (No final for this course)**		