

ME 3111 – Fluid Mechanics

Spring 2006

M,W,F 1:00 – 1:50 (Eng 290)

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Office Hours: Mon, Wed, Fri 2:00-3:00, Tue 1:00-2:00 (or by appointment)

Textbook: Required - Munson, Bruce R., Young, Donald F., Okiishi, Theodore H.,
Fundamentals of Fluid Mechanics, 5th Edition, John Wiley & Sons, Inc. (2006).

Course Web Page: http://www.d.umn.edu/~dpope/me3111/me_3111.htm Assignments, notes, etc will be posted on the website.

Course Catalog Description: (3.0 cr; prereq Engr 2026, BSChE, BSIE or BSME candidate or #; A-F only) Mass and energy balances, Bernoulli's Equation, momentum balance, laminar and turbulent flow, boundary layer theory, flow through porous media.

Prerequisites: Engr 2026, BSChE, BSIE or BSME candidate or #; A-F only

Course Components: The coursework consists of weekly homework, two midterm exams, a final exam and one project.

Homework:

- Weekly homework assignments will be announced in class and posted on the web page. They will be due in class (usually the following Wednesday).
- Homework solutions will be posted on the course web page.
- The specific format for the homework is given on the course web page.

Exams:

- The exams will be OPEN BOOK, CLOSED NOTES.
- You may use one page of handwritten (or typed) notes for each midterm.
- The final exam is comprehensive and you may use three pages of handwritten (or typed) notes.

Grading: The final percentage grade in the course is based on the following components:

Component	Percentage
Homework	25
Project	20
Two Midterm Exams (15% each)	30
Final Exam	25
Total	100

The corresponding minimum letter grade a student will receive is listed in the table below.

Percentage Grade		Letter Grade
Greater than or equal to	Less than	
0.0	59.5	F
59.5	66.5	D
66.5	69.5	D+
69.5	72.5	C-
72.5	76.5	C
76.5	79.5	C+
79.5	82.5	B-
82.5	86.5	B
86.5	89.5	B+
89.5	92.5	A-
92.5		A

The final letter grade awarded for the class may be higher than the minimum “earned” letter grade but will never be lower. Additional grading policies are listed in the **Attendance/Policies** section below.

Attendance/Policies: Attendance at all lectures is mandatory. Exceptions to this attendance policy will be made under extraordinary circumstances (e.g. personal or family emergency) or when the student arranges for an absence in advance.

The following additional policies apply during this course.

- Late assignments (unless prior arrangements are made) will be penalized 25%.
- Assignments that are handed in after solutions have been posted will not be given credit.
- Students are expected to act with honesty and respect (see the Student Conduct Code: <http://www.d.umn.edu/assl/conduct/code>).
- Unless specific instructions are given to the contrary, working with others on a given assignment is permissible (and encouraged).
- Copying someone else’s work is NOT permissible. Copied assignments will be given NO CREDIT.

- Using figures or text from a source without citing the source (plagiarism) is NOT permissible. If there is significant plagiarism within an assignment, the assignment will receive NO CREDIT.
- **Disabilities:** Individuals with any disability, either temporary or permanent, which might affect their ability to perform in this course, are encouraged to inform the instructor at the start of the semester. Adaptation of methods, materials, and/or testing may be modified as required to provide for equitable participation.
- **Equal Opportunity:** The University of Minnesota is committed to the practice that all of its students shall have equal educational opportunities. The University expressly forbids discrimination on the basis of race, color, gender, sexual orientation, disability, veteran's status, ethnicity, religion, creed, national origin, or marital status.

Class Assignment and Reading Schedule

Week	Day	Date	Reading Assignment	Topic	Assignment Due
ONE	Wed	18 Jan		Course Introduction	
	Fri	20 Jan	Ch. 1, pp. 1-13	Units, Properties, Ideal Gases	
TWO	Mon	23 Jan	Ch. 1, pp. 13-28	Viscosity, Compressibility, Vapor Pressure, Surface Tension	
	Wed	25 Jan	Ch. 2, pp. 38-56	Fluid Statics – Pressure Variation/Measurement	Hmwk #1
	Fri	27 Jan	Ch. 2, pp. 57-66	Hydrostatic Forces on Plane Surfaces, Pressure Prism	
THREE	Mon	30 Jan	Ch. 2, pp. 67-78	Forces on Curved Surfaces, Buoyancy	
	Wed	1 Feb	Ch. 3, pp. 94-112	Newton's 2nd Law, Bernoulli Equation, Total Pressure	Hmwk #2
	Fri	3 Feb	Ch. 3, pp. 112-125	Bernoulli examples, Flowrate Measurement	
FOUR	Mon	6 Feb	Ch. 3, pp. 125-134	Energy and Hydraulic Grade Line, Restrictions on Bernoulli	
	Wed	8 Feb	Ch. 4, pp. 150-168	Velocity Field, Acceleration Field	Hmwk #3
	Fri	10 Feb	Ch. 4, pp. 168-183	Reynolds Transport Theorem	
FIVE	Mon	13 Feb	Ch. 5, pp. 192-205	Control Volume Analysis - Conservation of Mass	
	Wed	15 Feb	Ch. 5, pp. 205-220	Linear Momentum	Hmwk #4
	Fri	17 Feb	Ch. 5, pp. 221-229	Moment-of-Momentum Equation	
SIX	Mon	20 Feb	Ch. 5, pp. 229-246	Energy Equation	
	Wed	22 Feb		Control Volume Analysis - Examples	Hmwk #5
	Fri	24 Feb	Review		

SEVEN	Mon	27 Feb	Exam 1 - Ch. 1-5		
	Wed	1 Mar	Ch. 6, pp. 272-289	Differential Analysis - Kinematics, Conservation of Mass and Linear Momentum	
	Fri	3 Mar	Ch. 6, pp. 289-307	Inviscid Flow, Plane Potential Flows	
EIGHT	Mon	6 Mar	Ch. 6, pp. 307-321	Superposition of Plane Potential Flows, Viscous Flow	
	Wed	8 Mar	Ch. 6, pp. 321-333	Solutions for Viscous, Incompressible Fluids	
	Fri	10 Mar	Ch. 7, pp. 346-365	Dimensional Analysis, Buckingham Pi Theorem, Common Dimensionless Groups	
Mon, 13 Mar – Fri, 17 Mar Spring Break					
NINE	Mon	20 Mar	Ch. 7, pp. 365-389	Correlation of Data, Modeling and Similitude	
	Wed	22 Mar	Ch. 8, pp. 401-417	Pipe Flow - Fully Developed Laminar Flow	Hmwk #6
	Fri	24 Mar	Ch. 8, pp. 418-436	Fully Developed Turbulent Flow, Dimensional Analysis	
TEN	Mon	27 Mar	Ch. 8, pp. 436-459	Minor Losses, Examples	
	Wed	29 Mar	Ch. 8, pp. 459-471	Multiple Pipe Systems, Flowrate Measurement	Hmwk #7
	Fri	31 Mar	Ch. 12, pp. 684-693	Turbomachines - Energy and Angular Momentum	
ELEVEN	Mon	3 Apr	Ch. 12, pp. 693-698	Centrifugal Pump	
	Wed	5 Apr	Ch. 12, pp. 698-706	Characteristics and Pump Selection	Hmwk #8
	Fri	7 Apr	Ch. 12, pp. 706-711	Dimensionless Parameters and Similarity Laws	
TWELVE	Mon	10 Apr	Ch. 12, pp. 711-714	Axial-Flow and Mixed-Flow Pumps, Fans	
	Wed	12 Apr	Ch. 12, pp. 715-726	Turbines and Project	Hmwk #9
	Fri	14 Apr	Review		

THIRTEEN	Mon	17 Apr	Exam 2 - Ch. 6-8, 12		
	Wed	19 Apr	Ch. 9, pp. 483-501	Flow Over Immersed Bodies - Characteristics, Boundary Layer	
	Fri	21 Apr	Ch. 9, pp. 501-518	Flat Plate, Transition, Effect of Pressure Gradient	
FOURTEEN	Mon	24 Apr	Ch. 9, pp. 518-535	Drag	
	Wed	26 Apr	Ch. 9, pp. 535-549	Lift	
	Fri	28 Apr	Ch. 10, pp. 561-574	Open-Channel Flow - Characteristics, Surface Waves, Energy Considerations	
FIFTEEN	Mon	1 May	Ch. 10, pp. 574-585	Energy Considerations, Uniform Depth Flow	Project Due
	Wed	3 May	Ch. 10, pp. 586-603	Gradually Varied Flow, Rapidly Varied Flow	
	Fri	5 May	Review		Hmwk #10
Comprehensive Final Exam					
Tues, 9 May, 12:00-1:55					