ME 303 A1: Fluid Mechanics Spring 2018

Lead Instructor:
Professor Tommaso Ranzani
Department of Mechanical Engineering
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Course schedule:
Lecture: Monday and Wednesday 10:10-11:55 (PHO 205)
Office hours: Wednesdays 12:30 – 1:30 PM (Ranzani – EMA 210)
for extra hours, please email tranzani@bu.edu

Discussions: Review material with GTF, practice problems, discuss homework
Fri: 12:20am-13:10pm PHO 205

Labs: ENG 113, time to be scheduled
GTF: Mahroo Bahreinian (mahroobh@bu.edu) Office Hours: Friday 9:00-10:00

Textbook: WileyPLUS: Fundamentals of Fluid Mechanics by Munson et al., Wiley 8th edition. No need for hard copy neither e-book. Visit www.wileyplus.com/go/coursefinder ·Enter your course ID, 679682 See pdf on Blackboard for more detailed instructions.

Course web page: Blackboard, WileyPLUS
Prerequisites: ENG EK 301 or equivalent.

Course learning objectives:
This course is designed to teach fundamental concepts of fluid dynamics through a broad range of applications. Course learning objectives are:

- Develop the ability to describe a fluid qualitatively and quantitatively
- Develop the ability to analyze a fluid under static and kinetic conditions
- Develop insight into how fluids flow close to and far from boundaries
- Gain an appreciation for the value of using experimental methods to measure fluid properties and characterizing fluid flow/behavior through dimensional analysis and lab-based experiments
- Gain experience in writing technical reports on lab-based experiments
- Gain insight into the application of fluid mechanics to practical problems in a variety of disciplines, including aerospace, mechanical, and biomedical engineering

Policy on collaboration:
Collaboration is encouraged on homework and labs; however, students should turn in their own work in their own words. No collaboration is permitted on exams.

Grading:

Homework (7%):	Problem sets assigned roughly every week
Lab reports (20%):	Two/Three laboratory exercises; must complete to pass the course
Exams (44%):	Two closed-book exams; formula sheet will be provided
Final Exam (23%):	Closed book; formula sheet will be provided.
Participation (6%):	Will be evaluated on **Top Hat**

Homework:
Homework assignments will be announced in class and on the course webpage. Homework must be brought to the ME front desk or through WileyPLUS.

- Due date and time will be specified on the assignment.
- Late homework will **not** be accepted.
- Policies on homework will be available for each assignment in WileyPLUS

Lab exercises:
There will be two lab exercises for this course. Sign-up sheets will be posted in advance of the labs. The experiments will be done in groups, but lab reports will be done individually.

- Reports are limited to a **strict 4-page length limit**. *pages beyond 4 will not be graded*
- Fonts must be 11 pt or larger, margins must be 1" or larger. Using LaTex is strongly recommended, online editors like Overleaf (https://www.overleaf.com) are encouraged. Plots and data analysis have to be done in Matlab.
- Students will not receive credit for turning in a laboratory report if they have not physically completed the laboratory exercise.
- Individual laboratory reports are due at 4 PM on to the ME office.
- Email submission is acceptable in cases of emergency; email both Prof. Ranzani and the GST.
- Late reports WILL NOT be accepted without prior approval from Prof. Ranzani.

Exams:
Each exam will take place over an entire class period. Each exam will cover a block of lectures as noted in the schedule. The Final Exam is cumulative.

- Missing an exam due to vacation is not excusable. Arrangements will be made on a case-by-case basis for documented emergencies or University conflicts.
- Students requiring additional time to complete examinations must supply proper documentation from the Office of Disability Services at ***least 5 business days in advance*** of an examination to the instructor so suitable arrangements can be made.
- The final exam Date and location will be made available on the website

Boston University Academic Conduct Code: Honesty is a core value of Boston University. Any violations of BU academic honesty and integrity standards ***will be pursued*** through appropriate University channels. This includes, but is not limited to: cheating, plagiarism and misrepresentation. If you have any questions as to what constitutes an honor code violation, please ask. ***Ignorance is not an excuse for cheating***. You may access the BU Academic Conduct Code at:
http://www.bu.edu/academics/policies/academic-conduct-code/

Course Schedule:
The following is an approximate schedule for the course. The GST and I will work with you to schedule your labs.

Date	Topic	Reading	
Jan 23	Introduction (Definitions, Viscosity, Surface Tension)	1	1
Jan 28	Fluid statics I (Pressure, Manometry, Hydrostatics)	2.1-2.7	2
Jan 30	Fluid statics II (Buoyancy, Fluid in Rigid-Body motion)	2.8-2.12	3
Feb 4	Fluid dynamics I (The Bernoulli Equation)	3.1-3.4	4
Feb 6	Fluid dynamics II (Examples of Use of the Bernoulli Equation)	3.4-3.6	5
Feb 11	Fluid kinematics I (velocity and acceleration fields)	4.1-4.2	6
	LAB I		
Feb 13	Fluid kinematics II (Reynolds Transport Theorem)	4.2-4.3	7
Feb 19	Control volume analysis I (Reynolds Transport Theorem, Conservation of Mass)	4.4, 5.1	8
Feb 20	Control volume analysis I (Conservation of Mass)	5.1	9
Feb 25	Control volume analysis II (Linear momentum)	5.2	10
Feb 27	Control volume analysis III (energy Equation)	5.3	11
Mar 4	Control volume analysis III, Differential analysis	5.3, 6.1	12
Mar 6	**I midterm (lect 1-11)**		13
Mar 18	Differential Analysis (Conservation of mass and kinematics)	6.1-6.2	14
Mar 20	Differential Analysis (Inviscid Flow Equations of Motion)	6.3-6.4	15
Mar 25	Differential Analysis (Plane Potential Flows).	6.5-6.7	16
Mar 27	Differential Analysis (Plane Potential Flows).	6.5-6.7	17

Apr 1	Differential Analysis (Viscous Flow)	6.8-6.9	18
Apr 3	Dimensional Analysis (Buckingham Pi Theorem)	7.0-7.7	19
Apr 8	Dimensional Analysis (Modeling and Similitude)	7.8-7.10	20
Apr 10	Viscous flow (Pipe flow, fully developed laminar flow)	8.1-8.2	21
Apr 15	Viscous flow (Fully developed Turbulent Flow)	8.3-8.4	22
Apr 17	Pipe flow examples and Viscous flow and Flow on immersed bodies (External Flow)	8.5, 9.1	23
	LAB II		
Apr 22	Flow on immersed bodies (boundary layer)	9.2	24
Apr 24	**II midterm (lect 12-22)**		25
Apr 29	Flow on immersed bodies (External Flow, boundary layer) and Flow on immersed bodies (Drag)	9.2, 9.3	26
May 1	Flow on immersed bodies (Drag) + creeping flow Flow on immersed bodies (Lift) Course Evaluations	9.3	27
	Final exam (9-11am PHO 205), on lect. 1-27		