ME 303 A2: Fluid Mechanics Fall 2021

Lead Instructor:
Professor Tommaso Ranzani
Department of Mechanical Engineering
730 Commonwealth Ave., EMA 210
Email: tranzani@bu.edu

Course schedule:
Lectures: Tuesday and Thursday 9:00 – 10:45 AM (MUG 205).

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

COVID 19 & BU Community Health Expectations:
Masks are required and face coverings must be worn over the mouth and nose at all times when in public spaces on campus, including classrooms. Students should be prepared to show proof that they are compliant with health attestations and testing in order to attend class. All students are expected to follow all university guidelines with respect to daily symptom checks, testing, and mask wearing when they leave their dorm or home. For a detailed description of official BU policies regarding COVID, please visit: *http://www.bu.edu/dos/policies/lifebook/covid-19-policies-for-students/*

Each student participating to in class activities will be required to comply with the aforementioned COVID 19 & BU Community Health Expectations.

Instructional forms
The class will have a flipped format; Videos will be assigned a week before each class. You will be expected to have watched the videos before class starts. Class time will be devoted to discussion of the material presented in the video, graded quizzes, and exercises.

Office hours: Thursdays 11:00 – 12:00 PM in person or via zoom (as you prefer)
*You need to register first on **this** sign-up sheet. For extra hours, please email tranzani@bu.edu*

Discussions: Discussion sections will be help by the GST and will focus on privind assistance on the homework assignments.

GST: Jacob Rogatinski (jrogat@bu.edu)

Textbook: WileyPLUS: Fundamentals of Fluid Mechanics by Munson et al., Wiley 8th edition. No need for hard copy neither e-book. The Wiley PLUS version will be used. Enter your course ID, A29498
See instruction on Blackboard

Google Forms: we will use Google Forms regularly to evaluate participation.

Course web page: Blackboard, WileyPLUS, Piazza (https://piazza.com/bu/fall2021/me303/home)
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

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- 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 to be submitted through WileyPLUS
Lab reports (13%):	Two/Three laboratory exercises; **must complete to pass the course**
Midterms (46%):	Two closed-book exams; formula sheet will be provided, no cheat sheet allowed.
Final Exam (27%):	Closed book; formula sheet will be provided, no cheat sheet allowed.
Participation (7%):	Will be evaluated with regular quizzes

Homework:
Homework assignments will be announced in class and on the course webpage. Homework must be submitted 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. Both of them can be done without being on campus. 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 through Blackboard.
- 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. Points will be removed for late submissions.

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.
- All exams will be closed book tests, the only reference materials that you will be permitted to use will have been given to you.
- In cheating is suspected you may be asked to sustain an oral exam.
- The final exam Date and location will be made available on the website

Extra credit labs:
Non-mandatory extra credit labs (two people max) will be proposed during the semester. If interested you should set up an appointment to discuss them in detail. I will grade them and give extra points on the midterm based on a two-pages report. **Only labs approved and discussed before by Prof Ranzani will be considered for extra points.**

Accommodations for Students with Documented Disabilities: If you are a student with a disability or believe you might have a disability that requires accommodations, requests for accommodations must be made in a timely fashion to Disability & Access Services, 25 Buick St, Suite 300, Boston, MA 02215; 617-353-3658 (Voice/TTY). Students seeking academic accommodations must submit appropriate medical documentation and comply with the established policies and procedures *http://www.bu.edu/disability/accommodations/*

Each exam will take place over an entire class period. Each exam will cover a block of lectures as noted in the schedule. ***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. Lectures will be prerecorded and assigned before coming to class. Class time will be dedicated to discussion of the material presented in class, examples, and practice exercises.

Date	Topic	Reading	Class
Sep 2, 2021	Introduction (Definitions, Viscosity, Surface Tension)	1	1
Sep 7, 2021	Fluid statics I (Pressure, Manometry)	2.1-2.3	2
Sep 9, 2021	Fluid statics I (Manometry, Hydrostatics)	2.4-2.7	3
Sep 14, 2021	Fluid statics II (Buoyancy, Fluid in Rigid-Body motion)	2.8-2.12	4
Sep 16, 2021	Fluid dynamics I (The Bernoulli Equation)	3.1-3.2	5
Sep 21, 2021	Fluid dynamics I (The Bernoulli Equation)	3.3-3.4	6
Sep 23, 2021	Fluid dynamics II (Examples of Use of the Bernoulli Equation)	3.4-3.6	7
Sep 28, 2021	Fluid kinematics (Reynolds Transport Theorem)	4.1-4.4	8
Sep 30, 2021	Control volume analysis I (Conservation of Mass)	5.1	9
Oct 5, 2021	Control volume analysis II (Linear Momentum)	5.2	10
	LAB I		
Oct 7, 2021	Control volume analysis III (Energy Equation)	5.3	11
Oct 14, 2021	Midterm preparation exercises		12
Oct 19, 2021	**I midterm (lect 1-12)**		13

Oct 21, 2021	Differential Analysis (Kinematics)	6.1	14
Oct 26, 2021	Differential Analysis (Conservation of mass)	6.2	15
Oct 28, 2021	Differential Analysis (Inviscid Flow Equations of Motion)	6.3-6.4	16
Nov 2, 2021	Differential Analysis (Plane Potential Flows).	6.5-6.7	17
Nov 4, 2021	Differential Analysis (Plane Potential Flows).	6.5-6.7	18
Nov 9, 2021	Differential Analysis (Viscous Flow)	6.8-6.9	19
Nov 11, 2021	Differential Analysis (Viscous Flow)	6.8-6.9	20
Nov 16, 2021	Dimensional Analysis (Buckingham Pi Theorem)	7.0-7.7	21
Nov 18, 2021	Dimensional Analysis (Modeling and Similitude)	7.8-7.10	22
Nov 23, 2021	**II midterm (lect 12-22)**		23
	LAB II		
Nov 30, 2021	Viscous flow (Pipe flow, fully developed laminar flow)	8.1-8.2	24
Dec 2, 2021	Viscous flow (Fully developed Turbulent Flow)	8.3 - 8.5	25
Dec 7, 2021	Flow on immersed bodies (External Flow, boundary layer)	9.1, 9.2	26
Dec 9, 2021	Drag and Lift	9.3, 9.4	27
	Final exam (on lect. 1-27)		

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