ME 303: Fluid Mechanics Spring 2020

Lead Instructor:
Professor Tommaso Ranzani
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Course schedule:
Lectures: Monday and Wednesday 10:10-11:55 (EPC 209)
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
PHO 205 Fri 12:20pm 1:10pm

Labs: ENG 113, time to be scheduled
GTFs: Allison Kaminski (allison9@bu.edu), Max McCandless (mdm1024@bu.edu) Office Hours: TBD

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, 748503 We negotiated a discounted price with Wiley, using the promo code BNU02. See pdf on Blackboard for more detailed instructions.

Top Hat: we will use Top Hat regularly to evaluate participation. You can register on the Top Hat website (https://tophat.com), the class is Fluid Mechanics and the Join Code is **622258**

Course web page: Blackboard, WileyPLUS, Piazza
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 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 on **Top Hat**

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. 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 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.
- **Exams written with pencil will not be accepted**
- All exams will be closed book tests, the only reference materials that you will be permitted to use will have been given to you.
- The final exam Date and location will be made available on the website

Demos:
Non-mandatory demos (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 demos approved and discussed before by Prof Ranzani will be considered for extra points.**

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.

Date	Topic	Reading	
Jan 22	Introduction (Definitions, Viscosity, Surface Tension)	1	1
Jan 27	Fluid statics I (Pressure, Manometry, Hydrostatics)	2.1-2.7	2
Jan 29	Fluid statics II (Buoyancy, Fluid in Rigid-Body motion)	2.8-2.12	3
Feb 3	Fluid dynamics I (The Bernoulli Equation)	3.1-3.4	4
Feb 5	Fluid dynamics II (Examples of Use of the Bernoulli Equation)	3.4-3.6	5
Feb 10	Fluid kinematics I (velocity and acceleration fields)	4.1-4.2	6
	LAB I		
Feb 12	Fluid kinematics II (Reynolds Transport Theorem)	4.2-4.3	7
Feb 18	Control volume analysis I (Reynolds Transport Theorem, Conservation of Mass)	4.4, 5.1	8
Feb 19	Control volume analysis I (Conservation of Mass)	5.1	9
Feb 24	Control volume analysis II (Linear momentum)	5.2	10
Feb 26	Control volume analysis III (energy Equation)	5.3	11
Mar 2	Differential analysis	5.3, 6.1	12
Mar 4	**I midterm (lect 1-11)**		13
Mar 16	Differential Analysis (Conservation of mass and kinematics)	6.1-6.2	14
Mar 18	Differential Analysis (Inviscid Flow Equations of Motion)	6.3-6.4	15
Mar 23	Differential Analysis (Plane Potential Flows).	6.5-6.7	16
Mar 25	Differential Analysis (Plane Potential Flows).	6.5-6.7	17
Mar 30	Differential Analysis (Viscous Flow)	6.8-6.9	18
Apr 1	Differential Analysis (Viscous Flow)	6.8-6.9	19
Apr 6	Dimensional Analysis (Buckingham Pi Theorem)	7.0-7.7	20
Apr 9	Dimensional Analysis (Modeling and Similitude)	7.8-7.10	21

Apr 13	Viscous flow (Pipe flow, fully developed laminar flow)	8.1-8.2	22
Apr 15	**II midterm (lect 12-22)**		23
	LAB II		
Apr 22	Viscous flow (Fully developed Turbulent Flow)	8.3 - 8.5	24
Apr 27	Flow on immersed bodies (External Flow, boundary layer)	9.1	25
Apr 29	Flow on immersed bodies (Drag and Lift)	9.2, 9.3	26
TBD	**Final exam (on lect. 1-26)**		