

BME 331

Introduction to Biofluid Mechanics

Fall 2013

Instructor: Prof. Joseph L. Bull
2204 Lurie Biomedical Engineering Building
734-647-5395
joebull@umich.edu

Note: email is generally a good way to contact me. **Please include “BME 331” in the subject.**

Lectures: Tuesdays and Thursdays, 9:30-11:30, G906 Cooley

Office Hours: 3:30-5:00pm on Tuesdays and Wednesdays, 2204 Lurie Biomedical Engineering Building (LBME).
Other times can be arranged by appointment. There will likely be some changes to the regular office hour times for some weeks, which will be announced in class and on CTools.

GSI: John Pitre
jpitre@umich.edu
Office hours: 3:30-5pm Mondays in 2189 LBME, and 1-2:30pm Wednesdays, in 3048 Shapiro.

Course URL: The course web page is on CTools, <https://ctools.umich.edu/portal>

Please check CTools frequently. The topic coverage schedule, homework assignments, any changes to office hours, and additional reading material will be posted there.

Course Text: *Fundamentals of Fluid Mechanics*, 7th edition by Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, Wade W. Huebsch, and Alric P. Rothmayer. (Wiley, NY, 2013) ISBN: 9781118116135.

Topics: This course introduces the fundamentals of biofluid dynamics and continuum mechanics, and covers the application of these principles to a variety of biological flows. Fluid flow in physiology and biotechnology is investigated at a variety of scales, ranging from subcellular to whole body.

Prerequisites: BME 231 and Math 216. Please talk to me if you haven't taken these.

Grading:	Exam 1	25%
	Exam 2	25%
	Exam 3	25%
	<u>Homework</u>	<u>25%</u>
	Total	100%

Exams: **Exam 1—October 10, 6-8pm (subject to room availability)**
Exam 2—November 14, 6-8pm (subject to room availability)
Exam 3—December 16, 1:30-3:30pm (scheduled final exam time)

Please let me know during the first week of the semester if you have any conflicts with this schedule

Homework: Homework will be assigned throughout the semester, approximately weekly. Expect a total of 7-10 assignments. For each assignment, you will have the option of working alone or in groups of two to four students. Some students find working in groups to be most beneficial, whereas others learn best by working alone. You should use your own past experience and preferences in deciding between working in a group and working alone on the homework. The exams provide an individual measure of comprehension and performance. Consequently, in order to prepare adequately for the exams, each student in a group must attempt to solve all of the assigned problems before the group meets to discuss and write up the homework.

The following policies govern the submission of group assignments:

1. All of the group member must work together on *all* the problems in an assignment.
2. There is an enforced maximum of four students per group.
3. You may use different groups on different assignments (but *not* on different problems within one assignment), or work in a group on some assignments and alone on others.
4. Each submitted homework solution must include a cover page with a list of the names and signatures of the group members. Your signature on the cover page certifies that you actively participated in solving or formulating solutions for all the problems in the assignment. Of course, your name and signature must be on the homework when it is turned in to receive credit.

Late assignments will not be accepted. Please present your solutions in a neat and easy to follow format. Twenty-five percent credit will be deducted from solutions that do not follow these guidelines:

1. Use 8.5" x 11" paper with straight edges, *not* paper torn from a spiral notebook.
2. Number all pages, e.g. 1/5, 2/5, ..., 5/5.
3. Box or underline the answer.
4. Staple all pages together.
5. Write and draw neatly and legibly.

Honor Code: The policies of the College of Engineering Honor Code, described at <http://www.engin.umich.edu/students/honorcode/>, apply to this course. You may work with others on the homework subject to the guidelines described above. The exams are solely an individual effort and are also subject to the guidelines described on the College of Engineering Honor Code site.

Grade Scale: Performance expectations (based on overall percentage grade) will not be higher than the following scale:

97-100%	A+
93-97%	A
90-93%	A-
87-90%	B+
83-87%	B
80-83%	B-
77-80%	C+
73-77%	C
70-73%	C-
67-70%	D+
63-67%	D
60-63%	D-
0-59%	E

Cell phones: Please turn cell phones to vibrate or silent before class. Ringing or beeping is disturbing to the class.

Schedule: This is a **tentative** schedule of the topics we will cover in this course. This may change slightly as we progress through the semester and **this schedule will be regularly updated on CTools.**

Week	Date	Reading	Topics Covered	HW
1	Sept. 3, 5	1.1-1.7	Introduction and Definitions	
2	Sept. 10, 12	1.8-1.11	Definitions and Properties	HW #1 due Sept. 12
3	Sept. 17, 19	2.1-2.5	Statics	HW #2 due Sept. 19
4	Sept. 24, 26	2.6-2.11	Statics, Buoyancy, problem session	HW #3 due Sept. 26
5	Oct. 1, 3	2.12-2.13, 7.1-7.6	Curved surfaces, Rigid Body Motion, Dimensional Analysis	HW #4 due Oct. 3
6	Oct. 8, 10	Review	Review, Exam 1	Exam 1 on Thursday Oct. 10
7	Oct. 17	3.1-3.9	Dimensional Analysis, Inviscid Flow	Fall Break Oct. 15, No HW this week
8	Oct. 22, 24	4.1-4.5	Inviscid Flow, Kinematics	HW #5 due October 24
9	Oct. 29, 31	5.1-5.3	Control Volume Analysis	HW #6 due Oct. 31
10	Nov. 5, 7	5.5	Control Volume Analysis	HW #7 due Nov. 7
11	Nov. 12, 14	Review	Review, Exam 2	Exam 2 on Thursday Nov. 14
12	Nov. 19, 21	6.1-6.3,	Differential Analysis	HW #8 due Nov. 21
13	Nov. 26	6.8-6.11	Differential Analysis	Thanksgiving break Nov. 28
14	Dec. 3, 5	8.1, 8.2, 8.4.1	Flow in Tubes	No HW
15	Dec. 10	Review	Review	HW #9 due Dec. 10
16	Dec. 16		Exam 3	Exam 3 on Monday Dec. 16