

Course Syllabus ▲▼

[Jump to Today](#)

1 Course Objectives

Welcome to BME I. The primary purpose of this course is for all students, irrespective of focus area, to attain basic knowledge of engineering methodology as applied to biological and/or medical problems.

The objectives of this course are:

1. To introduce you to classical and modern biomedical engineering concepts
2. To demonstrate how mathematics, physics, and biology can be used collectively to devise and implement solutions to biomedical problems
3. To help you develop an ability to identify, formulate, and solve engineering problems
4. To help you attain a holistic appreciation of the various disciplines within BME and to develop the ability to synthesize knowledge and apply concepts to various problems.
5. To help you develop an awareness of contemporary issues and the need for life-long learning

Pre-Requisites: BIOL C2005 Introduction to Biology I and BIOL C2006 Introduction to Biology II

Co-Requisites: BMEN E3810 BME Lab I, BMEN E4001 Quantitative Physiology I

TEXTBOOK/COURSE MATERIALS

– No textbook but can reference the book below. Relevant reading will also be provided for each module

[Introduction to Biomedical Engineering \(3rd Ed.\), Enderle JD, Bronzino J \(eds.\), Academic Press, 2011](http://www.amazon.com/Introduction-Biomedical-Engineering-Third-Edition/dp/0123749794) [↗\(http://www.amazon.com/Introduction-Biomedical-Engineering-Third-Edition/dp/0123749794\)](http://www.amazon.com/Introduction-Biomedical-Engineering-Third-Edition/dp/0123749794)

2 Instructor Information

Time: M, W, 10:10-11:25 am

Location: 303 Uris Hall

Instructor: Helen Lu, Ph.D. (Course Director) Professor of Biomedical Engineering

Office: Engineering Terrace, Suite 351.

Phone: 212-854-4071

E-mail: hhlucolumbia.edu

Office Hours: Wednesdays 11:30-12:30pm

Instructor: Qi Wang, Ph.D. (Course Director) Associate Professor of Biomedical Engineering

Office: Engineering Terrace, 351

Phone: 212-854-3657

E-mail: qiwangcolumbia.edu

Office Hours: TBA

Instructor: Nandan Nerurkar, Ph.D. Assistant Professor of Biomedical Engineering

Office: CEPSR 406

Phone: 212-854-2068

E-mail: nln2113columbia.edu

Office Hours: Mondays 4-5PM

TA: Office Hours – Tuesday 4-5pm (zoom) and Friday 4-5pm (in-person, ET343)

Biomechanics Module - Elaine Nagahara: ean2138@columbia.edu
(<mailto:jg4544@columbia.edu>)

Bioinstrumentation Module - Marc Sorrentino: mas2565@columbia.edu
(<mailto:yl3996@columbia.edu>)

Biomaterials Module - Collin Schmidt: cs4496@columbia.edu
(<mailto:jessica.z.liu@columbia.edu>)

3 Methods of Instruction

The course will be primarily lecture based and team-taught in a modular fashion. A BME faculty member will preside over each four-week module, providing instruction on the topics of interest. The in-class lectures of each module will also complement laboratory activities in BME Lab I (BMEN E3810)

Module	Date	Lecture	Comments
	3-Sep	Introduction: Prof. Lu	
BIOMECHANICS	08-Sep	Introduction to Biomechanics, Review Vectors & Coordinate Systems	Prof. Nandan Nerurkar
	10-Sep	Coordinate Transformation, Static Equilibrium	(TA: Elaine Nagahara)
	15-Sep	Strain and Stress	
	17-Sep	Constitutive Laws and Biological Considerations	
	22-Sep	Equations of Motion and Differential Equations	
	24-Sep	Beam Bending	
	29-Sep	Module Review	
	01-Oct	Module Final	

BIOINSTRUMENTATION	06-Oct	Biosensors	Prof. Qi Wang
	08-Oct	Electrical Safety in Biomedical Instrumentation	(TA: Marc Sorrentino)
	13-Oct	Linear Circuit Analysis	
	15-Oct	Frequency Analysis of Circuit	
	20-Oct	Passive Filtering	
	22-Oct	Basics of A/D	
	27-Oct	FFT and Signal Acquisition	
	29-Oct	Module review	
	03-Nov	Academic Holiday (enjoy!)	
	05-Nov	Module Final	

BIOMATERIALS	10-Nov	Introduction to Biomaterials, Biocompatibility	Prof. Helen Lu
	12-Nov	Structure- Property Relationships of Biomaterials	(TA: Collin Schmidt)
	17-Nov	Biomaterials: Metal, Ceramics	
	19-Nov	Biomaterials: Ceramics, Polymer	
	24-Nov	Biomaterial: Polymers and Current Trends	
	26-Nov	Happy Thanksgiving Break!!	
	01-Dec	Biomaterial Applications: Implant Design/Clinical Perspective	
	03-Dec	Module Review	
	08-Dec	Module Final	

4 Method of Evaluation

Mastery of concepts conveyed in BME I will be assessed using a combination of homework assignments and a final examination. The grades from these exercises contribute to your final grade as follows:

Homework: 30%

Module Finals: 70%

4.1 Homework (30%)

Homework assignments will allow you to apply and further investigate the lecture topics. These exercises may include problem sets, derivations, and/or applied, open-ended problems.

4.2 Module Final (70%)

At the conclusions of each module, a module final will be administered. These finals will be 75 minutes, closed-book. Only simple calculator will be needed (no phone/app permitted). Each final will cover a variety of topics from the module and evaluate your understanding of the critical concepts, as well as synthesis and integration of material learned from the three modules. Each Module Final will be preceded by a module review session held in class, this will be a good opportunity to address any lingering conceptual questions.

5 Class Policies

5.1 Class Ethics – Follow the Columbia Honor Code

You are expected to adhere to the highest ethical standards in this course. Cheating in any form WILL NOT be tolerated. Be sure that you submit original work; **do not copy!** Use of external sources is acceptable, but cite where appropriate. Anyone caught cheating will be subject to academic discipline in accordance with the rules of Columbia University. Cheating includes, but is not limited to: plagiarism work, data, or conclusions; accessing third parties during examinations or quizzes; and using unauthorized notes.

5.2 Expectations of Students and Instructors

The faculty and TAs for this course are here to optimize your learning experience. We want this course to be enjoyable and to properly prepare you for your post-graduate career. You can expect the following from the instructors and TAs (adapted from Howard Culbertson at Southern Nazarene University, <http://home.snu.edu/~HCULBERT/contact.htm>):



1. A syllabus that describes class procedures, policies, and a course description
2. Any change to the course schedule will be provided to students within 48 hours of the change

3. The course instructor and TAs will be available out of class either at pre-defined office hours or by appointment
4. E-mails to the instructor or TAs will be returned in a timely fashion
5. That the instructors and TAs will answer any and all questions to the best of our abilities.

The faculty and TAs expect the following from students:

1. Students will arrive to class/labs on time
2. Student will notify instructor in advance of circumstances that prevent the student from attending a lecture or exam
3. Students will adhere to Columbia University's Code of Academic Integrity

Course Summary:

Date	Details	Due
Thu Oct 2, 2025	 Module 1 Midterm Exam (https://courseworks2.columbia.edu/courses/227376/assignments/1542505)	due by 5:00pm
Mon Nov 10, 2025	 Module 3 In-class Work (https://courseworks2.columbia.edu/courses/227376/assignments/1559965)	due by 10:30am

 [Module 1 Homework 1](https://courseworks2.columbia.edu/courses/227376/assignments/1543961)
(<https://courseworks2.columbia.edu/courses/227376/assignments/1543961>)



 [Module 1 Homework 2](https://courseworks2.columbia.edu/courses/227376/assignments/1543962)
(<https://courseworks2.columbia.edu/courses/227376/assignments/1543962>)

 [Module 1 Homework 3](https://courseworks2.columbia.edu/courses/227376/assignments/1543963)
(<https://courseworks2.columbia.edu/courses/227376/assignments/1543963>)

 [Module 2 Exam](https://courseworks2.columbia.edu/courses/227376/assignments/1586129)
(<https://courseworks2.columbia.edu/courses/227376/assignments/1586129>)

 [Module 2 Homework 1](https://courseworks2.columbia.edu/courses/227376/assignments/1546450)
(<https://courseworks2.columbia.edu/courses/227376/assignments/1546450>)

 [Module 2 Homework 2](https://courseworks2.columbia.edu/courses/227376/assignments/1586130)
(<https://courseworks2.columbia.edu/courses/227376/assignments/1586130>)

Date	Details	Due
	 Module 3 Exam (https://courseworks2.columbia.edu/courses/227376/assignments/1586128)	
	 Module 3 HW 1 (https://courseworks2.columbia.edu/courses/227376/assignments/1572361)	