

# **Boston University ENG EK 301: Engineering Mechanics I**

## **SYLLABUS FOR FALL 2017**

**NOTE:** You are expected to read through this document and be familiar with the policies and dates described within; print out, sign, and pass in the signature page with your first homework assignment. Some dates may be subject to change; changes will be announced in class, via email, and on the website. Check this document prior to emailing your instructors for logistical information.

### **INSTRUCTORS**

Prof. Michael Albro

Section A4

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Prof. Glynn Holt

Section A6

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Prof. Katherine Zhang

Sections A3, A5

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Office hrs: Tues 10-12, or by appt

### **SECTIONS**

A1: TR 9 – 10:45 pm, PHO 117

A3: MW 2:30 – 4:15 pm, PHO 210

A5: MW 12:20 – 2:05 pm, PHO210

A2: TR 1:30 – 3:15 pm, PHO 210

A4: TR 6:30 – 8:15 pm, PHO 117

A6: MW 2:30 – 4:15 pm, EPC 207

### **GRADUATE STUDENT TEACHERS (GSTs)**

A1: Nic Vickers ([nvickers@bu.edu](mailto:nvickers@bu.edu))

A3: Quang-Thinh Ha ([qth20@bu.edu](mailto:qth20@bu.edu))

A5: Drew Martin ([ajmart@bu.edu](mailto:ajmart@bu.edu))

A2: Arman Karimian ([armandok@bu.edu](mailto:armandok@bu.edu))

A6: Artin Spiridonoff ([artin@bu.edu](mailto:artin@bu.edu))

### **UNDERGRADUATE LEARNING ASSISTANTS (LAs)**

A1 Sonny Ray Dominguez ([sonnyray@bu.edu](mailto:sonnyray@bu.edu)), Brian Cha ([briancha98@bu.edu](mailto:briancha98@bu.edu))

A2: Matthew Hinshaw ([mhinshaw@bu.edu](mailto:mhinshaw@bu.edu)), Khalid Khumayis ([khumayis@bu.edu](mailto:khumayis@bu.edu))

A4: Olivia Blouin ([orblouin@bu.edu](mailto:orblouin@bu.edu))

A5: Shuying (Vanna) Liu ([lshuying@bu.edu](mailto:lshuying@bu.edu)), Rohin Banerji ([rohinb96@bu.edu](mailto:rohinb96@bu.edu))

A6: Brian Kim ([blkkim@bu.edu](mailto:blkkim@bu.edu)), Connor (Cass) Leach ([csleach@bu.edu](mailto:csleach@bu.edu))

### **TEXTBOOK AND REFERENCES**

**Required:** R.C. Hibbeler, Engineering Mechanics: Statics, 14<sup>th</sup> ed., Pearson Prentice Hall (12<sup>th</sup> – 13<sup>th</sup> editions fine as well)

#### **Additional references:**

Meriam, Kraige, & Bolton, Engineering Mechanics Statics, 8<sup>th</sup> ed., Wiley, 2015

Bedford, Fowler, & Liechti, Statics and Mechanics of Materials, Pearson Prentice Hall

## DISCUSSION SECTION

EK301 instruction consists of your biweekly lecture section and an *open-door* discussion section. Your course registration asked you to sign up for a specific discussion section, but attendance is purely voluntary and you are not required to attend the section that you registered for; you can attend any discussion section. The discussion section is held in room 202 (110 Cummington Mall) and is run by the Graduate Student Teachers (GSTs) and Learning Assistants (LAs). The GST/LAs will be present to answer any questions you may have on the lecture material, as well as to provide basic homework assistance. Note that their job is not to do the homework for you! We recommend that you first try the homework on your own, and then visit the discussion section to get help from the GST or LA if you get stuck or have specific questions.

The hours are: Mon 6:30–9:15 pm, Tues 3:30–9 pm, Weds 4:30–9 pm

## WEBSITE

The course website is on BlackBoard ([learn.bu.edu](http://learn.bu.edu)). Electronic materials will be posted periodically throughout the semester, so check the website often for updates. These will include the course syllabus, homework solutions, and document for the truss project. Keep in mind that all sections will have the same homework and project assignments, but the quizzes and exams will be unique for each section. **Note** that while grade assignments will be posted for your review, we do NOT use the Blackboard Grade Center to calculate semester grades. Ignore any interpretation of your grade based on whatever Blackboard-reported “points” that are displayed.

## GRADING

Your progress and evaluation for the course material will consist of weekly problem sets, weekly in-class quizzes, two in-class exams, a design project, and a final exam. The two lowest **quiz** grades will be dropped. The breakdown for the grade weighting is:

Homework	7.5%
Weekly quizzes	17.5%
Design project	15%
Each exam	20%

Due to the importance of the design project, failure to participate in the project will result in a failing grade for the course. Nominally, the mean of the overall score in a section will set the dividing line between a B- and a C+.

## PROBLEM SETS AND QUIZZES

One of the best methods to learn the material is to read the text *before* the material is presented in class, attend and pay attention in class, and work through the assigned problem sets. The course is structured to give you ample feedback regarding your understanding of the material through the problem sets and quizzes. By working through the problem sets, you will prepare yourself for the in-class quiz, which in turn will prepare you for the in-class exams. Assistance will be provided in the Discussion Section, so please seek out help if you need it!

Another helpful practice is to alternate teaching the problems to your classmates, which will force you to think about how to tackle and solve a problem. It is common for engineers to work in groups, so keeping in mind the Ethics Code, we encourage you to form groups to work out (but not copy) the problem sets. The quizzes and exams are solo efforts, however, so it is in your best interest to make sure you understand the problem set and not rely too heavily on your classmates or the GST & LA.

A perfect homework solution (this applies to quizzes and exams as well) should be:

- (a) legible and well organized, with labeled Free Body Diagrams
- (b) demonstrate a thought process and worked-out steps
- (c) correct!

Each problem will be graded on a 10/7/0 scale. A high score of 10 indicates that you worked through the entire problem and came to a correct or mostly correct solution. A score of 7 indicates that you made a valiant effort and a 0 will be given for a minimal attempt or lack thereof. Partial credit will be given for all forms of evaluation, so steps (a) and (b) are in your best interest! If you are short on time (particularly for the quizzes and exams), please at least attempt to set up and show your steps for how to solve the problem. Please keep the following rules in mind when writing up your solution:

- (a) Your name, section number, and problem set number must appear at the top of every sheet.
- (b) Do not submit work that has ragged edges.
- (c) Start each problem on a new page.
- (d) Indicate the final solution by drawing a solid box around it.

Problem sets will be based on lecture material, and generally will be due at the beginning of the Wednesday/Thursday lecture. Since solutions to the problem sets will be posted following the final Thursday lecture, **late problem sets are not permitted** and will receive a zero.

Quizzes (~15 mins) will be *based* on the homework problems, and will be given on the lecture *following* the homework due date (typically on the next Monday/Tuesday). Your problem sets will likely not be graded and returned to you before the quiz, so please study the posted solutions to the problem sets in order to prepare for the quiz. The two lowest scores will be dropped, but if you miss a quiz **without prior arrangement**, you will be given a zero.

## PROJECT

A chief activity of an Engineer is to apply their skills to design and build, not just study. The goal of an engineering education is to develop the ability to apply your course work to recognize, define, and solve real problems in creative but practical ways. There are many aspects of engineering practice that are as important as writing and solving equations. In EK301 we will introduce you to some of these aspects through an exciting design contest.

The contest will involve designing, building, and testing a truss made from soda straws and straight pins. The truss will have to bridge a pre-specified distance and support a minimum load. You will have to experimentally determine certain physical properties of the soda straws, and use your measurements to analyze and optimize your design to support as much weight as possible. The project will culminate in a contest in which your truss will be loaded until it collapses. Your grade will depend, in part, on how close the results of your failure analysis come to the actual failure results during testing.

Further details will be presented later in the semester.

## EXAMS

There will be two in-class exams given during the semester, administered in class on October 16/17<sup>th</sup> and November 14/15<sup>th</sup>. **DO NOT MAKE TRAVEL PLANS FOR THESE DATES.**

The final exam will be given during the final exam period, and the date is TBD. Since the Registrar will set the date later during the semester, **DO NOT MAKE TRAVEL PLANS BEFORE THE END OF THE EXAM PERIOD.**

Make-up exams will be given only in extreme circumstances. It is your responsibility to let your instructor know as far in advance as possible of an unavoidable conflict or medical emergency.

### **CLASS POLICY**

We expect that if you are registered for EK301, you should attend class. Most of the course material can be found in a textbook, but not everything, and you will be tested on what is covered in class, not what is simply covered in the textbook. Tuition at B.U. is expensive, so make the most of your time and money by taking advantage of all the resources you are paying for! We also expect that you will do your best to pay attention during lecture. You will have a busy schedule with many academic (and social) demands, so we know from experience that paying attention 100% of the time can be a difficult task. However, we do ask that you not distract your peers if your attention starts to wander. Please ignore all forms of non-approved (!) electronic communication temptation (texting, email, web surfing, etc) and turn off your cell phone during class.

If you find that we are going over material too quickly or you do not understand something crucial, don't hesitate to ask questions during lecture. For shorter questions, see your instructor, GST, or LA outside of class.

### **ETHICAL RESPONSIBILITIES**

Cheating on homework, quizzes, exams, project reports, or any form of assignment, may be a form of plagiarism and is an infringement of every code of engineering ethics. Plagiarism is a serious academic offense and should not be taken lightly. Understanding your ethical responsibilities is an integral part of becoming a professional. A copy of the Code of Ethics of engineers, promulgated by the Accreditation Board for Engineering and Technology (ABET) and the National Society of Professional Engineers, can be found on the main course web site.

Please recall that when you enrolled at Boston University, you agreed to an Academic Honesty Pledge. A copy of this pledge can be found in your student handbook. It details your responsibilities as well as the results of code violations.

### **DROP AND WITHDRAWAL DATES**

The last day to DROP (with no 'W' on your record): Monday, October 10<sup>th</sup>

The last day to WITHDRAW (with a 'W' on your record): Friday, November 10<sup>th</sup>

### **INCOMPLETES**

Incompletes will be permitted only for extenuating circumstances, and must be arranged with your instructor before the final exam.

### **COURSE EVALUATIONS**

There will be a standard course evaluation near the end of the semester, including a written evaluation on how well you believe the course accomplished its stated learning outcomes. These outcomes are described on the ABET course syllabus, which is posted on the ME course webpage.

We would be happy to discuss any comments and concerns that may arise during the semester during our office hours.

## **TECHNOLOGY and ACTIVE LEARNING in EK301**

EK301 transitioned to a new lecture format starting in the Spring 2012 semester. Our hope is that this new format will better help you learn the material. Periodically throughout each lecture, you will work in 4-person groups on example problems.

Your instructor may opt to have your group work on an iPad tablet or some other means to document your work. A large part of the analysis in EK301 comes from successful diagnosis of the forces that act on a structure, so correctly drawing the relevant free body diagram(s) (FBD) is a vital but difficult first step. Use of the iPad during lecture will consist of you and your group writing down the steps you took to tackle the problem and wirelessly submitting the work, all within a 15-minute time period. The faculty and GSTs will circulate around the room to provide assistance if necessary, so don't hesitate to ask for help! At the end of the exercise the lecturer will review the work and highlight correct steps and common mistakes. The goal is to provide you with immediate feedback on your comprehension of the material (particularly on the graphical analysis), rather than have you wait several weeks for your graded assignments to be returned. Your files will additionally be available for download after lecture.

You will NOT be graded on the quality or correctness of your work, but don't be surprised if your group's work gets presented to the class during the feedback portion. Your names will not be publicized, but feel free to take credit if your steps were correct. However, since the feedback portion is as important as your work effort, you should show all the steps you followed to the solution, even if you're not sure if they're correct. Just try to be as systematic and orderly as possible so we can make sense of your work.

### *Groups*

You will be assigned groups to work in throughout the semester. The purpose of the assignments is to generate a working conversation on how to tackle the problem, and working with someone who you don't necessarily know is a great way to learn. In order to cover the material in a timely fashion and to allow the faculty space to circulate through the lecture hall, please put your bags and coats in the back of the lecture hall when you enter, and sit in your group-designated seats during the entirety of the lecture. If you find you don't particularly enjoy your group, please try to make the best of things and take heart that the groups will be switched up twice throughout the semester. If you find you are experiencing serious problems with one or more group members, please discuss the matter with the faculty and we will try to resolve the situation. We will administer peer feedback surveys midway and at the end of each group setting, so you'll have a chance to let us know how things are going. You are free to choose your own group from within your section for the design project.

Please designate a member of your group to be in charge of drawing out your work. This person should not be solely responsible for the work! We ask that you rotate this role within your group as the lectures proceed.

### iPad policy

In order to provide feedback on your analysis, you will work out the example problem on an iPad tablet based on your group discussion. The iPad is an ideal tool to enable the faculty to provide penalty-free feedback on your understanding of the concepts. One tablet and stylus will be provided for each group during lecture and will be distributed and collected at the beginning and end of each lecture. The iPad is an ideal tool for getting distracted from the course! As such, we expect a high level of responsibility for your use of these devices. They should be used only to

work out the problem, and not, for example, be used to play Angry Birds or catch up on Facebook (internet access, iTunes, and app installation have been disabled to remove all temptations!).

## IPAD DRAWING APP

The app that you'll be using is called SyncSpace. As with all drawing apps, you'll find a small learning curve as you become comfortable with the program. Please follow the general format for each problem that you work:

1. SyncSpace should already be launched when you get the tablet, so make sure to stay in the app for the entire lecture (ie, don't press the 'Home' button). The GTF will have already made up several problem templates for you. If we tackle more than one example problem in lecture, select the page on the left as the first example and the page next to it as the second example.
2. The problem image and text description will be displayed on the projector. Start the problem by working out the FBD, followed by the mathematical analysis. Be sure to show all steps; don't erase unless absolutely necessary.
3. When you're finished, draw a red box around the final solution. Save your work by clicking on the curved arrow in the upper right corner and selecting 'Open PDF In...'. Select the 'DropBox' option and save it by the your section number ('A'), lecture number ('Lx'), group number ('Gx'), and the example number ('Ex'):  
AL1G8E2.pdf

A few tips:

- Your previous steps can be undone by selecting the counter-clockwise arrow icon, and you can subsequently re-do this step by selecting the clockwise arrow icon.
- Mistake marks can be erased using the eraser tool. Note that the eraser removes an entire, unbroken line. Please do not select and erase the problem graphic. If you do this by accident, use the undo feature.
- Zoom by pinching two fingers together. Scroll by using two fingers together.
- If you run short of space on the canvas, simply scroll zoom out and scroll down for more room.

## IPAD USE FAQS

1. Q: Can I use my own iPad or tablet to do the group problems?  
A: No. The software and logistical organization of the files and course credit is such that the EK301 iPads must be used for in-class group problem solving exercises.
2. Q: Do we lose credit in the course if we make mistakes on our iPad exercises?  
A: No. The purpose behind the iPad exercises is to help you learn new material and get feedback without the concern of losing credit.
3. Q: Can we download apps to play games or surf the web using the iPads during lecture?  
A: Ha-ha. No.
4. Q: Can I switch groups to be with one of my friends?  
A: No, but you will be asked to switch groups periodically throughout the semester. The faculty chooses the groups with the purpose of mixing up student ability to foster an ideal learning environment. Learning to work with new peers is an important skill that you'll need for the rest of your life. If you truly have a problem with someone in your group that cannot be resolved on your own, please talk to one of your instructors privately.

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I've read through this document and the semester dates that follow.

Signature: \_\_\_\_\_

EK301 Fall 2017 Semester Mon/Weds Schedule and Syllabus					
L #	Date	Reading	Agenda	Quiz # (on)	HW
1	9/6	C2:1-7	Introduction, vector review		
2	9/11	C3:1-4	Multiple forces, static equilibrium	Q1 (Ethics)	
3	9/13	C3:1-4	Internal tensions		#1 due
4	9/18	C2:8-9	Dot product, projections	Q2 (HW 1)	
5	9/20	C4:1-4	Moments; Cross product		#2 due
6	9/25	C4:5-8	Moment projections; couples; equivalent systems	Q3 (HW 2)	
7	9/27	C5:1-3	2-D static equilibrium; Project introduction		#3 due
8	10/2	C5:1-3	Supports, reaction forces	Q4 (HW 3)	
9	10/4	C5:1-3	Reaction forces		#4 due
10	10/10	C5:4,7	Static indeterminacy; 2-3 force members	Q5 (HW 4)	
11	10/11	C5:5	3-D supports and static equilibrium		#5 due
12	10/16	Thru HW 4	<b>EXAM 1</b> (covers through HW 4 material)		
13	10/18	C5:5, C6:1-3	Truss analysis: Method of joints		
14	10/23	C6:4	Truss analysis: Method of sections	Q6 (HW 5)	
15	10/25	C6:6	Frames 1		#6 due
16	10/30	C6:6	Frames 2	Q7 (HW 6)	
17	11/1	C6:6	Frames 3/Frames module		#7 due
18	11/6	C8:1-3	Dry Friction (structures, wedges)	Q8 (HW 7)	
19	11/8	C9:1-2	Distributed forces: centroids		#8 due
20	11/13	C4:9, C9:4	Centroids & COM continued; distributed forces		
21	11/15	Thru HW 8	<b>EXAM 2</b> (covers through HW 8)		
22	11/20	C11:1-3	Virtual work		#9 due
23	11/27	C11:1-3	Virtual work	Q9 (HW 9)	
24	11/29	C11:1-3	Virtual work		#10 due
25	12/4	C7:1-3	Shear/bending	Q10 (HW 10)	
26	12/6	C7:1-3	Shear/bending moment eqns & diagrams		
27	12/11	Class notes	Uni-axial stress/strain		#11 due

IMPORTANT SEMESTER DATES	
TBD	<b>Straw testing</b>
10/10	<b>Last day to drop without a 'W'</b>
10/25	<b>Straw testing report due</b>
11/10	<b>Last day to withdraw (with a 'W')</b>
11/17	<b>Preliminary design report due</b>
12/8	<b>Final design report due</b>
12/9	<b>Truss testing</b>



EK301 Fall 2017 Semester Tues/Thurs Schedule and Syllabus					
L #	Date	Reading	Agenda	Quiz # on...	HW
1	9/5	C2:1-7	Introduction, vector review		
2	9/7	C3:1-4	Multiple forces, static equilibrium		
3	9/12	C3:1-4	Internal tensions	Q1 (Ethics)	
4	9/14	C2:8-9	Dot product, projections*		#1 due
5	9/19	C4:1-4	Moments; Cross product	Q2 (HW 1)	
6	9/21	C4:5-8	Moment projections; couples; equivalent systems		#2 due
7	9/26	C5:1-3	2-D static equilibrium; Project introduction	Q3 (HW 2)	
8	9/28	C5:1-3	Supports, reaction forces		#3 due
9	10/3	C5:1-3	Reaction forces	Q4 (HW 3)	
10	10/5	C5:4,7	Static indeterminacy; 2-3 force members		#4 due
11	10/12	C5:5	3-D supports and static equilibrium	Q5 (HW 4)	#5 due
12	10/17	Thru HW 4	<b>EXAM 1</b> (covers through HW 4 material)		
13	10/19	C5:5, C6:1-3	Truss analysis: Method of joints		
14	10/24	C6:4	Truss analysis: Method of sections	Q6 (HW 5)	
15	10/26	C6:6	Frames 1		#6 due
16	10/31	C6:6	Frames 2	Q7 (HW 6)	
17	11/2	C6:6	Frames 3/Frames module		#7 due
18	11/7	C8:1-3	Dry Friction (structures, wedges)	Q8 (HW 7)	
19	11/9	C9:1-2	Distributed forces: centroids		#8 due
20	11/14	Thru HW 8	<b>EXAM 2</b> (covers through HW 8)		
21	11/16	C4:9, C9:4	Centroids & COM continued; distributed forces		
22	11/21	C11:1-3	Virtual work		#9 due
23	11/28	C11:1-3	Virtual work	Q9 (HW 9)	
24	11/30	C11:1-3	Virtual work		#10 due
25	12/5	C7:1-3	Shear/bending	Q10 (HW 10)	
26	12/7	C7:1-3	Shear/bending moment eqns & diagrams		
27	12/12		Uni-axial stress/strain		#11 due

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TBD	Straw testing
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