EGR201 Mechanics of Solids
Class: TuThu 1:25PM–2:40pm, Teer 203
Lab: Section 1: Wed 3:05-4:20am, Hudson 115A
Section 2: Wed 4:40-5:55pm, Hudson 212

Instructor	Prof. Firas A. Khasawneh	**TAs**
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Textbook: R.C. Hibbeler, Statics and Mechanics of Materials, 3rd ed., (Prentice Hall, 2011). Any supplemental course material will be posted on Sakai.

Communication: Check Sakai frequently, i.e., daily. In the event I must communicate urgently to the class then I will send and email in addition to posting an announcement.

Grading Scheme:

Homework:	20	Exams (3 exams, 15 each):	45
Lab reports:	15	Final Exam:	30
		Total:	**110**

Note: The contribution of the lowest midterm towards your total score will be reduced by 10 points.

Exams: Each exam during the regular semester is worth 15 points. The final exam is comprehensive and is worth 30 points.
The final exam is scheduled on Wednesday 12/12 2:00PM–5:00PM at Teer 203.

Homework: You must use the homework format described on Sakai. Homework solutions will be available after the deadline.

- Work submitted for a grade in this course will typically be due by 4:30pm on a Friday. For specific due dates you are referred to the course Sakai website. You should deposit your homework in the appropriately labeled lockbox located in 118 Hudson Hall. No credit will be given for late homework unless an extension is granted prior to the submission date.
- Collaboration on homework problems is strongly encouraged, but each person should submit his/her own work. Cite all collaborators—persons who provided any source of assistance. If none, write "Collaborators: none".

Computer use: It is the formal policy of this class that computers are necessary. This includes access to and the use of the Internet. Additional requirements are the use of Matlab or equivalent.

Class attendance: Attendance at Lectures and Laboratories is mandatory.

Other behavior expectations: Students are expected to take a sincere interest in learning the classroom material and to abide by the Duke Community Standard (DCS). Keeping with this expectation, students should: 1) not create distractions (i.e. turn cell phones off and put laptops away), 2) show up to class on time, and 3) be courteous to other students and the instructor. Violations of the DCS will be dealt with appropriately and may involve the Undergraduate Conduct Board.

Help and peer tutoring: Good study habits are absolutely essential to your success in this course. If you feel you are having difficulty keeping up with work, please talk to me as soon as possible so we can figure out a plan to get you and your study habits back on track. The TAs and I will make every effort to assist you but please restrict your in-person inquiries to our office hours and immediately after class. In addition, students in EGR 75L are eligible for free tutoring through the Academic Resource Center's Peer Tutoring Program. Tutoring will run from September 7th-December 7th. You can find more information and request a tutor via the ARC website: www.duke.edu/arc.

Course description: This course has several objectives. The first is to help you develop curiosity and persistence to understand and describe the mechanics of your environment. The second objective is to provide you with the opportunity to discover how to learn engineering material. That is, how to take technical notes, how to prepare homeworks, how to present lab reports, and how to approach tests. The third objective is to help you learn how to analyze solid objects with a collection of loads acting on them

and determine how the forces "flow" from the applied loads, through the solid material, to the supports. In so doing, you will practice the use of some very important and powerful principles, such as equilibrium, continuity, material deformation, and the mathematical tools used to describe them.

Course objectives:

1. Apply classical Newtonian mechanics, basic elements of vector analysis, and free body diagrams to analyze static equilibrium of solid and structural systems in two and three dimensions.

2. Analytically describe and model the stresses and strains within axial stress members, torsional shafts, beams, and columns, acting either in isolation or in simple structural configurations.

3. Be able to conduct and describe basic laboratory and computational experiments used to characterize the deformability of solids and structures.

4. Integrate objectives (1)-(3) to make elementary design calculations involving factors of safety for determinate and some simple indeterminate systems, and to describe the role of such calculations in the engineering design process.

Lab schedule

Week	Date	Lab
1	8/27	No lab
2	9/3	When engineering fails (DVD)
3	9/10	Secrets of Lost Empires: Stonehenge (DVD) (**LR**)
4	9/17	Carrier: City of Steel (DVD)
5	9/24	Problem solving session
6	**10/3**	**Exam 1**
7	10/8	No lab
8	10/15	Tensile test (**LR**)
9	10/22	Problem solving session
10	**10/31**	**Exam 2**
11	11/5	Torsion test (**LR**)
12	11/12	Problem solving session
13	11/19	No lab (thanksgiving)
14	**11/28**	**Exam 3**
15	12/3	Column buckling (**LR**)

Note: '**LR**' indicates that a report should be submitted for this lab. Check the course website for the format and the due date.

Lecture Schedule

Week	Date	Topics	Reading
		Statics	
1	8/28	Introduction	1
	8/30	Vectors	2,3.2
2	9/4	Equivalent force systems	3.1, 3.3–3.7
	9/6	CoG & centroid	3.8, 6.1–6.3
3	9/11	Equilibrium, FBDs	4.1–4.6
	9/13	Equilibrium, FBDs	
4	9/18	FBDs: Friction	4.7, 4.8
	9/20	FBDs: Trusses	5.1–5.4
5	9/25	FBDs: Frames	5.5
		FBDs: Internal forces	7.1, 7.2
		Mechanics of Materials	
		Stress & Strain	
	9/27	Stress	7.3–7.5
6	10/2	Mohr's Circle	14.1–14.5
	10/4	Mohr's Circle	
7	10/9	Strain	7.8,7.9, 14.6–14.9
	10/11	Constitutive relations	8, 14.10
		Connections	7.6,7.7
8	10/16	Fall break	
		Axial	
	10/18	Axial stress concentrations	9.1, 9.7
		Axial deformations	9.2
9	10/23	Superposition	9.3
		Pressure vessels	13.1
		Torsion	
	10/25	Stress & strain	10.1–10.3, 10.7
10	10/30	Deformation	10.4, 10.5
		Beams	
	11/1	V & M diagrams	11.1–11.2
11	11/6	Normal stress	11.3,11.4,11.6,6.5,6.6
	11/8	Shear stress & shear flow	12
12	11/13	Shear stress & shear flow	
	11/15	Combined states of stress	9.3,13.2,16.4
13	11/20	Bending deformations	16.1–16.4
	11/22	Thanksgiving recess	
14	11/27	Bending deformations	
		Instability	
	11/29	Column buckling	17.1–17.3
15	12/4	Column buckling	
	12/6	Review	