Department of Mechanical Engineering
ME EN 1300 · Statics and Introduction to Strength of Materials
Fall 2016

Syllabus

Instructor:	Dr. Spear, MEK 2151, *email correspondence via course website only*
TAs:	Michael Price, *email correspondence via course website only*
	Tyler Jones, *email correspondence via course website only*
Units:	4
Meeting times:	M,T,W,Th,F: 7:30am-8:20am, MEK 3550
Office hours:	Dr. Spear: M,T,Th,F 8:30am-9:00am in MEK 2151
	Tyler Jones: M 3-5pm (location TBD)
	Michael Price: Th 3-5pm (location TBD)
Required textbooks:	*Vector Mechanics/Statics*, 10th edition. Beer, Johnston & Mazurek.
	Mechanics of Materials, 6th edition. Beer, Johnston, DeWolf & Mazurek.
Also required:	A scientific calculator with trigonometric functions built in
	Audience Response System ("clicker") – available in bookstore
	Engineering computation paper – available in bookstore
Course website:	Hosted on Canvas
Prerequisites:	A working knowledge of vector algebra, solving multiple systems of equations, trigonometry, analytic geometry, and calculus

Clickers:
Most of you have used or already own "clickers". We will use them in this class for bonus quizzes and exam reviews. Used clickers are available in the bookstore for ~$40. Another alternative is to purchase a license and use your phone to act as a clicker in class. To look at license options and costs, visit: http://store.turningtechnologies.com/ and enter the school code jo2S for the university discount. **All device IDs must be registered through Canvas by September 1**. To register, click on the Clicker Registration Tool located in the modules section of Canvas. If, for some reason, you show up to class with someone else's clicker, please let me know so that I can associate your score with your name.

Course summary:
This course covers the subject of Statics and provides an introduction to Strength of Materials. Statics involves the evaluation of external and internal forces on rigid body systems. Strength of Materials involves the evaluation of deformation on NON-rigid body systems due to external and internal forces. Topics that will be covered include: forces, moments, couples, and resultants; static equilibrium and statically equivalent force systems, center of gravity; free body method of analysis; friction; internal forces in members, concept of stress and strain; Hooke's law with

application to problems in tension/compression, shear torsion, bending, and prediction of material failure.

Course objectives:
By the end of this course, you should be able to:

1) Solve problems in structural mechanics involving concentrated and distributed forces and couples, knowing how and when to replace them with equivalent resultant forces and moments;
2) Identify and enforce boundary conditions (e.g., pinned, roller, friction, traction-free, etc.);
3) Identify conditions of static equilibrium;
4) Compute center of gravity;
5) Draw and analyze free body diagrams to find reaction forces or moments and to find internal forces in members;
6) Use the concepts of stress and strain, including orientation-transformation methods;
7) Apply Hooke's Law to problems in tension/compression, shear torsion and bending;
8) Know and test the limits of applicability of the relevant governing equations.

Deliverables and grading:

Homework	30%
Midterm exams	40%
Final exam	30%

≥93	<93 ≥90	<90 ≥87	<87 ≥83	<83 ≥80	<80 ≥77	<77 ≥73	<73 ≥70	<70 ≥67	<67 ≥63	<63 ≥60	<60
A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

The total score is the weighted average of the homework, midterm exams, and final exam, as described in the table above. A curve (upward) will be applied only if the scores on exams are lower than expected; otherwise, no curve will be applied. To account for "bad days", the two lowest homework scores will be dropped. If a student is on the borderline between two grades, the instructor will take into account the following factors before making a final grading decision: class attendance, involvement in the online discussion forum, and general effort put forth toward learning the subject.

Homework and homework submission policies:
Statics and Strengths are core areas for almost any engineering discipline. As such, they are covered on the fundamentals of engineering (FE) exam. The primary way to learn and become proficient in these areas is by practice. Therefore, two homework assignments will be due per week. Some of the problems on the homework will come from the back of the textbooks, but most will not, which leaves you with plenty of remaining practice problems to prepare for your exams. Homework assignments will be posted on Canvas, and an announcement will be made both through Canvas and in class when an assignment has been posted.

Failure to adhere to the following homework submission policies will result in point deductions and possibly a zero score.

1. **Format and engineering paper**. Because this is one of the first engineering courses that you will take during your engineering education, it is *critical* that you not only learn the course material and general approach to solving engineering problems, but that you also adopt a specific format when writing your homework solution. The same (or similar) format will be expected in nearly every engineering course to follow and is often used in engineering practice. Engineering paper must be used and is available for purchase at the campus bookstore and online. In the header portion of the paper, include the following information:

	Name	Homework # - Problem #	Due Date	Page #

   The main body of the homework should include the following sections:
   Given:
   Find:
   Assumptions: (if any)
   Solution

   There should be no more than one problem solution on any page, and you should only use the front side of the paper. The final answer should be clearly demarcated (e.g. boxed or circled). An example solution format is available on Canvas.
2. **Neat, legible, and stapled.** Homework assignments that are not readable or are otherwise difficult to decipher will be returned with a zero or reduced score. All pages of an assignment must be stapled together before submission; students are fully responsible for any lost pages if the pages are not stapled together before submission.
3. **Show all work.** Clearly show all steps of the problem solution. Partial credit can only be given if a sufficient amount of detail is shown. If you only provide the final answer with no work to communicate how you obtained that answer, no points will be given. Using a computer to bypass solution steps is not allowed, though you are welcome to use one to check your final answers.
4. **Working with others is encouraged. Copying is not allowed.** Part of the learning process comes from communicating with others. However, you will learn nothing from simply copying others' work. Exams are worth more than homework for a reason—if you simply copy homework solutions from others, you are likely to fail the exams.
5. **Submission deadline.** Homework must be turned in at the beginning of class the day it is due. No late homework will be accepted. Your two lowest homework scores will be dropped, which should cover the occasional car accident, hospital visit, family emergency, etc. If you have something more long-term going on in your life that will prevent you from submitting homework on time, please see me ahead of time.

We only have two TAs for the entire class, and they are limited in the amount of time that they can spend on grading each week. Because of the number of students, assignments, and limited work hours for TAs, only half of each assignment can be graded in detail. The remaining problems will be given a score based on completeness. Solutions to all problems will be posted after the assignment is due.

Midterms:
There will be three non-cumulative midterms. All midterms are closed-book and closed-notes. Exams cannot be taken at different times/dates, except as documented in accordance with university policy.

Final exam: Wednesday, December 16, 8:00-10:00am
The final will be comprehensive and is closed-book and closed-notes with the exception of the statics and mechanics sections of the FE-supplied reference handbook (posted on Canvas). Any additional equations required to solve the problems will be provided on the exam itself. We will have clicker reviews in class prior to the final exam as well as an out-of-class Q&A session (TBD) so that you can ask any last-minute questions. Attendance at the Q&A session is not required and is held only for your benefit.

Bonus quizzes:
Bonus quizzes will be held 0-2 times per week. The purpose of the quizzes is for me to gauge class understanding on certain topics and to give students who are struggling an opportunity to prove that they are attending class regularly and trying to learn the material. These will be very short (~5 minute) quizzes and are usually at the beginning of class. Quizzes cannot be made up. At the end of the semester, points earned from these quizzes will be added to your total homework score.

Snow:
Inevitably, it will snow in Salt Lake City at some point during the semester. Know that classes continue as scheduled unless the university officially closes. For very snowy days, I recommend you take public transportation if necessary. Make sure to give yourself plenty of extra time, as it will take longer to get to campus. Being familiar with the public transportation route *before* the day of the "big snow" will decrease your anxiety on that day.

Conduct and responsibilities:
The Student Handbook is available online (http://registrar.utah.edu/handbook/index.php). All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.

COLLEGE OF ENGINEERING GUIDELINES

http://www.coe.utah.edu/wp-content/uploads/pdf/faculty/semester_guidelines.pdf **Fall Semester 2015**

Appeals Procedures

See the Code of Student Rights and Responsibilities, located in the Class Schedule or on the UofU Web site for more details

Appeals of Grades and other Academic Actions

If a student believes that an academic action is arbitrary or capricious he/she should discuss the action with the involved faculty member and attempt to resolve. If unable to resolve, the student may appeal the action in accordance with the following procedure:

1. Appeal to Department Chair (in writing) within 40 business days; chair must notify student of a decision within 15 days. If faculty member or student disagrees with decision, then,
2. Appeal to Academic Appeals Committee (see http://www.coe.utah.edu/current-undergrad/appeal.php for members of committee). See II Section D, Code of Student Rights and Responsibilities for details on Academic Appeals Committee hearings.

Americans with Disabilities Act (ADA)

The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you need accommodations in a class, reasonable prior notice needs to be given to the instructor and to the Center for Disability Services, 162 Olpin Union, 581-5020 (V/TDD) to make arrangements for accommodations. All written information in a course can be made available in alternative format with prior notification to the Center for Disability Services.

Repeating Courses

When a College of Engineering class is taken more than once, only the grade for the second attempt is counted. Grades of **W, I, or V** on the student's record count as having taken the class. Some departments enforce these guidelines for other courses as well (e.g., calculus, physics). See an advisor or departmental handbook. Students should note that anyone who takes a required class twice and does not have a satisfactory grade the second time may not be able to graduate.

Withdrawal Procedures

See the Class Schedule or web for more details ** Please note the difference between the terms "drop" and "withdraw". Drop implies that the student will not be held financially responsible and a "W" will not be listed on the transcript. Withdraw means that a "W" will appear on the student's transcript and tuition will be charged. **

Drop Period – No Penalty

Students may DROP any class without penalty or permission during the FIRST TEN academic days of the term (Friday, September 4, 2015).

Withdrawal from Full Term Length Classes

Students may WITHDRAW from classes without professor's permission until **Friday, October 23, 2015.** Between September 5 and October 23, a "W" will appear on the transcript AND tuition will be charged. Refer to Class Schedule, Tuition and Fees for tuition information.

Withdrawal from Session I & Session II

See the web page for details:
http://registrar.utah.edu/academic-calendars/fall2013.php

Withdrawals **after October 23** will only be granted due to compelling, nonacademic emergencies. A petition and supporting documentation must be submitted to the Dean's Office, 1602 Warnock Engineering Building or University College (450 SSB) if you are a pre-major. Petitions must be received before the last day of classes (December 10, 2015).

Adding Classes

Please read carefully: All classes must be added within two weeks of the beginning of the semester (deadline: Friday, September 4). Late adds will be allowed September 5-14, requiring only the instructor's signature. Any request to add a class after September 14th will require signatures from the instructor, department, and Dean, and need to be accompanied by a petition letter to the Dean's office.

A $50 FEE WILL BE ASSESSED BY THE REGISTRAR'S OFFICE FOR ADDING CLASSES AFTER September 14th. ***

WEEK-BY-WEEK SCHEDULE

Lecture	Date	Topic	Reading	HW Due	
	WEEK 1				STATICS
1	M: Aug. 24	Introduction, Units	Chapter 1, 2.10		
2	T: Aug. 25	Force vectors, resultants, components	2.1-6		
3	Th: Aug. 27	2D/3D Cartesian (rectangular) vectors	2.7-8		
4	F: Aug. 28	3D Cartesian vectors continued	2.12	HW 1	
	WEEK 2				
5	M: Aug. 31	Position vectors, dot (scalar) product	2.13, 3.9		
6	T: Sep. 1	Equilibrium of a particle in 2D	2.9-11	HW 2	
7	Th: Sep. 3	Equilibrium of a particle in 3D	2.14-15		
8	F: Sep. 4	Cross (vector) product, moments	3.4-8	HW 3	
	WEEK 3				
	M: Sep. 7	**NO CLASS (LABOR DAY)**			
9	T: Sep. 8	Moments about an axis	3.11	HW 4	
10	Th: Sep. 10	Couples	3.12-14		
11	F: Sep. 11	Equivalent systems of forces & couples		HW 5	
	WEEK 4				
12	M: Sep. 14	Equilibrium of rigid bodies in 2D			
13	T: Sep. 15	Equilibrium of rigid bodies in 2D and 3D	3.15-3.17	HW 6	
14	Th: Sep. 17	Exam 1 review	4.1-5		
	F: Sep. 18	**EXAM 1 (covers material from HW 1-6)**	4.6-4.9		
	WEEK 5				
15	M: Sep. 21	Distributed loads, centroids of areas	5.1-5,5.8-9		
16	T: Sep. 22	Centroids of volumes	5.6-7,5.10-12	HW 7	
17	Th: Sep. 24	Truss analysis (method of joints)	6.1-4		
18	F: Sep. 25	Truss analysis (method of sections)	6.7	HW 8	
	WEEK 6				
19	M: Sep. 28	Frames	6.9-11		
20	T: Sep. 29	Machines	6.12	HW 9	
21	Th: Oct. 1	Shear and bending moment diagrams	7.1-5		
22	F: Oct. 2	Shear and bending moment diagrams	7.6	HW 10	
	WEEK 7				
23	M: Oct. 5	Friction	8.1-4		
24	T: Oct. 6	Wedges and screws	8.5-6	HW 11	
25	Th: Oct. 8	Exam 2 review			
	F: Oct. 9	**EXAM 2 (covers material from HW 7-11)**			
	WEEK 8	**NO CLASS (FALL BREAK)**			
	Oct. 12-16				
	WEEK 9				
26	M: Oct. 19	Friction in rotating machinery (disks, belts, etc.)	8.8-10		
27	T: Oct. 20	Moment of inertia (second moment)	9.1-5	HW 12	
28	Th: Oct. 22	Parallel axis theorem, MOI of composite areas	9.6-7		
29	F: Oct. 23	Stress (normal, shearing, bearing)	1.3-7	HW 13	

	WEEK 10			
30	M: Oct. 26	Stress and design considerations	1.8-13	
31	T: Oct. 27	Strain	2.1-4	HW 14
32	Th: Oct. 29	Hooke's Law, axial deformation, Poisson's ratio	2.5, 2.8, 2.11	
33	F: Oct. 30	Relationships among material properties	2.12-15	HW 15
	WEEK 11			
34	M: Nov. 2	St. Venant's Principle, stress concentrations	2.17-18	
35	T: Nov. 3	Torsion	3.1-3	HW 16
36	Th: Nov. 5	Torsion	3.4-5	
37	F: Nov. 6	Beams: bending moment, stress, deformation	4.1-4	HW 17
	WEEK 12			
38	M: Nov. 9	Beams: shear and bending moment diagrams	5.1-3	
39	T: Nov. 10	Beams: shear stress	6.1-3	HW 18
40	Th: Nov. 12	Exam 3 review		
	F: Nov. 13	**EXAM 3 (covers material from HW 12-18)**		
	WEEK 13			
41	M: Nov. 16	Stress transformation	7.1-2	
42	T: Nov. 17	Principal stresses	7.3	
43	Th: Nov. 19	Mohr's circle	7.4-5	
44	F: Nov. 20	Strain transformation	7.1	HW 19
	WEEK 14			
45	M: Nov. 23	Measuring strain	7.13	
46	T: Nov. 24	Failure criteria	7.7-8	HW 20
	Th: Nov. 26	**NO CLASS (THANKSGIVING)**		
	F: Nov. 27			
	WEEK 15			
47	M: Nov. 30	Beam deflection	9.1-3	
48	T: Dec. 1	Superposition and basic beam tables	9.5, 9.7-8	
49	Th: Dec. 3	Column buckling	10.1-4	
50	F: Dec. 4	Special topics in statics and strengths		HW 21
	WEEK 16			
51	M: Dec. 7	Course content review and debriefing		
52	T: Dec. 8	Course content review and debriefing		HW 22
53	Th: Dec. 10	Course content review and debriefing		
	W: Dec. 16	**FINAL EXAM (comprehensive)**		

STRENGTHS (MECHANICS OF MATERIALS)