



**Department of Mechanical Engineering**  
**ME EN 3000 – Design of mechanical elements – Spring 2014**

**Syllabus**

<b>Instructor:</b>	<b>Prof. B. Raeymaekers</b> , MEB 2122, bart.raeymaekers@utah.edu
<b>Office Hours:</b>	Tue 12–1pm, Wed 1-2pm, Thu 8:30-9am (MEB 2122), + by appointment.
<b>Units:</b>	3
<b>Meeting Times:</b>	M, W, F: 09:40am -10:30am, WEB L101
<b>Engineering Lab:</b>	CADE Lab and Engman Lab
<b>Required Text:</b>	<i>Shigley's Mechanical Engineering Design</i> , Budynas & Nisbett (9 <sup>th</sup> Ed.) Occasional extra readings will be made available on the course website. Note: using an older edition of the text book is acceptable. Homework problems will not be drawn from the text book.
<b>Reference Texts:</b>	<i>Mechanical Engineering Design</i> , Shigley & Mischke (5 <sup>th</sup> Ed.) <i>Fundamentals of Machine Component Design</i> , Juvinall & Marshek <i>Mashinenelemente</i> , Roloff & Matek <i>Mechanics of Materials</i> , Beer and Johnston
<b>Course Website:</b>	Hosted on CANVAS
<b>Pre-requisites:</b>	<b>ME EN 2450, 2650, 2655 and Upper Division ME Status</b>
<b>Co-requisites:</b>	<b>ME EN 3210, 3300, 3650</b>
<b>Course TA:</b>	Mike Doran, mike.doran@utah.edu / Stephen Lucich, slucich@utah.edu
<b>Homework session:</b>	Mo 1-2pm (Mike), Wed 3-4pm (Stephen), WEB 1460

**Course summary:**

ME EN 3000 is the first course in the Senior Design Sequence - ME EN 3000, 4000, 4010. The course introduces a wide range of standard mechanical elements that are extensively used in today's engineering world. The topics include reliability, fits and tolerances, rolling element and fluid film bearings, fasteners, welded joints, shafts, and material selection.

**Course objectives:**

This course will provide the student with the tools and methods to solve real world engineering problems that involve the design of mechanical elements. At the end of the course the student will be able to

1. apply basic science principles to engineering design problems.
2. apply principles of strength of materials, fluid mechanics, and solid mechanics to calculate and design mechanical elements such as bolted and welded joints, bearings, and shafts.
3. understand, analyze, and select mechanical components in typical engineering design scenarios.

**Course topics:**

- Part 1: Introduction to mechanical design
- Part 2: Material selection
- Part 3: Statistical considerations
- Part 4: Tolerances
- Part 5: Area moment of inertia
- Part 6: Design for static strength
- Part 7: Design for fatigue strength
- Part 8: Design of shafts
- Part 9: Design of bolted joints
- Part 10: Design of welded joints
- Part 11: Rolling element bearings
- Part 12: Lubrication

**Deliverables and grading:**

Homework	20%
Two Midterm exams	2 x 20%
Final exam	40%

The total score is the weighted average of the homework sets, the midterm exams, and the final exam. **THE TOTAL SCORE WILL BE CURVED.** However, a total score  $s$  within the intervals given in the table will guarantee the corresponding letter grade shown, or better.

	A	B	C
Total score $s$	$s > 90$	$80 < s \leq 90$	$70 < s \leq 80$

The instructor will only curve the total scores upward if the scores on exams and assignments are lower than expected. It is anticipated that the mean total score will result in a B- letter grade.

**Exam dates:**

Midterm exam 1: Mo 02/10/2014 (in class)

Midterm exam 2: Fri 03/21/2014 (in class)

Final exam: Thu 04/24/2014, 8:00 am – 10:00 am (WEB L101)

Exams cannot be taken at different times/dates, except for documented medical reasons.

All exams are “closed book”. Midterm material will be specified in a timely manner. The final exam will be comprehensive. A review session will be held prior to each exam, outside of normal class meeting times.

A scientific calculator can be used during the exams (no programmable or graphical calculators).

A cheat sheet will be provided to each student with each exam. This cheat sheet will be made available on the course website at the beginning of the semester.

**Homework hand in guidelines:**

- **WHERE:** Drop box outside the ME front office, MEB 2110.
- **WHEN:** by 5:00 pm on the day the homework set is due.
- **HOW:** HARD COPY ONLY! Do not e-mail soft copies to the instructor or the TA.
- **Late HW** needs to be slid under the door of the instructor's office, and will be accepted until 11:00 am the day after the HW set was due. A 20% penalty will be applied to the grade of that homework set. No late HW will be accepted after 11:00 am the day after its due date. Note: If HW is due on Friday, the next day is Saturday, NOT Monday.

The ( $N-2$ ) best homework set scores will be counted towards the total grade, where  $N$  is the total # of homework sets, i.e., the two lowest homework scores may be dropped. There will be a total of approximately ten homework sets.

The TA will hold a homework Q&A session each week.

Each homework problem will contain a "hand in" section that details the intermediate and partial answers for which need to be solved. Partial credit is allotted according to the bullet points specified in the "hand in" section of each homework problem. It is suggested that students use it as a check-list prior to handing in their homework set to maximize the (partial) credit they will receive.

***Academic dishonesty policy: ME EN 3000 will strictly follow the standard academic policy outlined by the University and the College of Engineering.***

**Faculty and student responsibilities:**

***No laptops, cellular/smart phones are allowed during class meeting times. These can be disruptive and distracting to your class mates.***

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 (Article XI) 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.

"Faculty...must strive in the classroom to maintain a climate conducive to thinking and learning." PPM 8-12.3, B.

"Students have a right to support and assistance from the University in maintaining a climate conducive to thinking and learning." PPM 8-10, II. A.

ADA statement: "The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations." ([www.hr.utah.edu/oeo/ada/guide/faculty/](http://www.hr.utah.edu/oeo/ada/guide/faculty/))

Week	Lecture #	Day	Date	Topic	Reading
1	1	M	1/6/2014	Course intro	
1	2	W	1/8/2014	Part 1: Intro to design	Shigley 1.1 - 1.11, 1.14 - 1.16
1	3	F	1/10/2014	Part 2: Material selection	Shigley 2.1 - 2.11
2	4	M	1/13/2014	Part 2: Material selection	Shigley 2.12 - 2.20
2	5	W	1/15/2014	Part 3: Statistical considerations	Shigley 20.1 - 20.2
2	6	F	1/17/2014	Part 3: Statistical considerations	Shigley 20.3 - 20.4, 1.12
3		M	1/20/2014	MLK jr. Day	
3	7	W	1/22/2014	Part 3: Statistical considerations	
3	8	F	1/24/2014	Part 4: Tolerances	Shigley 1.13, 7.8
4	9	M	1/27/2014	Part 4: Tolerances	
4	10	W	1/29/2014	Part 4: Tolerances	
4	11	F	1/31/2014	Part 5: Moment of inertia	Review your notes from ME 1300
5	12	M	2/3/2014	Part 6: Design for static strength	Shigley 3.1, 3.2,3.4 - 3.6, 3.8, 3.9
5	13	W	2/5/2014	Part 6: Design for static strength	Shigley 3.10 - 3.13, 3.17
5	14	F	2/7/2014	Part 6: Design for static strength	Shigley 5.1 - 5.5, 5.7 - 5.10
6	15	M	2/10/2014	Midterm 1	
6	16	W	2/12/2014	Part 7: Design for fatigue strength	Shigley 6.1-6.5, 6.7, 6.8
6	17	F	2/14/2014	Midterm 1 overview & discussion	
7		M	2/17/2014	Presidents day	
7	18	W	2/19/2014	Part 7: Design for fatigue strength	Shigley 6.1-6.5, 6.7, 6.8
7	19	F	2/21/2014	Part 7: Design for fatigue strength	Shigley 6.9 - 6.12, 6.15
8	20	M	2/24/2014	Part 7: Design for fatigue strength	
8	21	W	2/26/2014	Part 8: Design of shafts	Shigley 7.1 - 7.4
8	22	F	2/28/2014	Part 8: Design of shafts	Shigley 7.5
9	23	M	3/3/2014	Part 8: Design of shafts	Shigley 7.6, 7.7
9	24	W	3/5/2014	Part 8: Design of shafts	
9	25	F	3/7/2014	Part 8: Design of shafts	
10		M	3/10/2014	Spring break	
10		W	3/12/2014	Spring break	
10		F	3/14/2014	Spring break	
11	26	M	3/17/2014	Part 9: Design of bolted joints	Shigley 8.1, 8.2
11	27	W	3/19/2014	Part 9: Design of bolted joints	Shigley 8.3 - 8.8
11	28	F	3/21/2014	Midterm 2	
12	29	M	3/24/2014	Part 9: Design of bolted joints	Shigley 8.10, 8.11
12	30	W	3/26/2014	Midterm 2 overview & discussion	
12	31	F	3/28/2014	Part 9: Design of bolted joints	Shigley 8.12
13	32	M	3/31/2014	Part 9: Design of bolted joints	
13	33	W	4/2/2014	Part 10: Design of welded joints	Shigley 9.1, 9.2, 9.8, 9.9
13	34	F	4/4/2014	Part 10: Design of welded joints	
14	35	M	4/7/2014	Part 10: Design of welded joints	
14	36	W	4/9/2014	Part 10: Design of welded joints	
14	37	F	4/11/2014	Part 10: Design of welded joints	
15	38	M	4/14/2014	Part 11: Rolling contact bearings	Shigley 11.1 - 11.5, 3.19
15	39	W	4/16/2014	Part 11: Rolling contact bearings	Shigley 11.6, 11.12
15	40	F	4/18/2014	Part 12: Lubrication	Shigley 12.1, 12.2, 12.4 - 12.6
16	41	M	4/21/2014	Review for final exam	
16	42	W	4/23/2014	No Lecture	
16		Thu	4/24/2014	Final Exam 8:00 - 10:00 am	