Department of Mechanical Engineering
ME EN 3000 – Design of mechanical elements – Spring 2019

Syllabus

Instructor:	**Prof. B. Raeymaekers**, MEK 2676, bart.raeymaekers@utah.edu
Office Hours:	M/F 1:00-1:30 pm, W 12:30-1:00 pm (MEK 2676) + when door is open
Units:	3
Meeting Times:	M, W, F: 9:40 am - 10:30 am, MEK 3550
Engineering Lab:	CADE Lab and Engman Lab
Required Text:	*Shigley's Mechanical Engineering Design,* Budynas & Nisbett (10th 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. The text book is on two-hour reserve at the Marriott Library.
Reference Texts:	*Mechanical Engineering Design*, Shigley & Mischke (5th Ed.) *Fundamentals of Machine Component Design*, Juvinall & Marshek *Mashinenelemente*, Roloff & Matek *Mechanics of Materials*, Beer and Johnston
Course Website:	Hosted on CANVAS
Pre-requisites:	**ME EN 2450, 3300 and Upper Division ME Status**
Co-requisites:	**ME EN 3210, 3650**
Course TA:	Milo Prisbrey, Karl Niendorf

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	$s > 90$	$80 < s \leq 90$	$70 < s \leq 80$

Exam dates:

Midterm exam 1: 02/13/2019 (in class)
Midterm exam 2: 03/22/2019 (in class)
Final exam: Thu 04/25/2019, 8:00 am – 10:00 am (MEK 3550)
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 scientific calculator can be used during the exams (no programmable or graphical calculators). A formula sheet will be provided to each student with each exam. This formula sheet will be made available on the course website at the beginning of the semester.

Homework hand in guidelines:

Your HW should be clean and the solution method to each problem should be clearly organized. Do not forget to indicate units.

- **WHERE:** Drop box outside the ME front office, MEK 1550.
- **WHEN:** by 5:00 pm on the day the homework 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).

- **Individual work:** Your HW submission must be your individual work. You are not allowed to share solutions, solution methods, and/or matlab code with others.

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 ten homework sets. 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.

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

- ***Homework must be your individual work, and cannot be collaborative with others.***
- ***Only scientific, non-programmable calculators can be used during exams.***
- ***A formula sheet will be provided with each exam; no additional materials are allowed.***

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/)

Week	Lecture #	Day	Date	Topic	Reading (Shigley Edition 10)
1	1	M	01/07/2019	Course intro	
1	2	W	01/09/2019	Part 1: Intro to design	Shigley 1.1 - 1.11, 1.15 - 1.17
1	3	F	01/11/2019	Part 2: Material selection	Shigley 2.1 - 2.11
2	4	M	01/14/2019	Part 2: Material selection	Shigley 2.12 - 2.20
2	5	W	01/16/2019	Part 3: Statistical considerations	Shigley 1.12
2	6	F	01/18/2019	Part 3: Statistical considerations	
3		M	01/21/2019	MLK jr. Day	
3	7	W	01/23/2019	Part 3: Statistical considerations	
3	8	F	01/25/2019	Part 4: Tolerances	Shigley 1.14, 7.8
4	9	M	01/28/2019	Part 4: Tolerances	
4	10	W	01/30/2019	Part 4: Tolerances	
4	11	F	02/01/2019	Part 5: Moment of inertia	Review your notes from ME 1300
5	12	M	02/04/2019	Part 6: Design for static strength	Shigley 3.1, 3.2, 3.4 - 3.6, 3.8, 3.9
5	13	W	02/06/2019	Part 6: Design for static strength	Shigley 3.10 - 3.13, 3.17
5	14	F	02/08/2019	Part 6: Design for static strength	Shigley 5.1 - 5.5, 5.7 - 5.10
6	15	M	02/11/2019	Part 6: Design for static strength	
6	16	W	02/13/2019	Midterm 1	
6	17	F	02/15/2019	Midterm 1 overview & discussion	
7		M	02/18/2019	President's Day	
7	18	W	02/20/2019	Part 7: Design for fatigue strength	Shigley 6.1-6.5, 6.7, 6.8
7	19	F	02/22/2019	Part 7: Design for fatigue strength	Shigley 6.1-6.5, 6.7, 6.8
8	20	M	02/25/2019	Part 7: Design for fatigue strength	Shigley 6.9 - 6.12, 6.15
8	21	W	02/27/2019	Part 7: Design for fatigue strength	
8	22	F	03/01/2019	Part 8: Design of shafts	Shigley 7.1 - 7.4
9	23	M	03/04/2019	Part 8: Design of shafts	Shigley 7.5
9	24	W	03/06/2019	Part 8: Design of shafts	Shigley 7.6, 7.7
9	25	F	03/08/2019	Part 8: Design of shafts	
10		M	03/11/2019	Spring break	
10		W	03/13/2019	Spring break	
10		F	03/15/2019	Spring break	
11	26	M	03/18/2019	Part 8: Design of shafts	
11	27	W	03/20/2019	Part 9: Design of bolted joints	
11	28	F	03/22/2019	Midterm 2	
12	29	M	03/25/2019	Midterm 2 overview & discussion	
12	30	W	03/27/2019	Part 9: Design of bolted joints	Shigley 8.3 - 8.8
12	31	F	03/29/2019	Part 9: Design of bolted joints	Shigley 8.10, 8.11
13	32	M	04/01/2019	Part 9: Design of bolted joints	Shigley 8.12
13	33	W	04/03/2019	Part 9: Design of bolted joints	
13	34	F	04/05/2019	Part 10: Design of welded joints	Shigley 9.1, 9.2, 9.8, 9.9
14	35	M	04/08/2019	Part 10: Design of welded joints	
14	36	W	04/10/2019	Part 10: Design of welded joints	
14	37	F	04/12/2019	Part 10: Design of welded joints	
15	38	M	04/15/2019	Part 10: Design of welded joints	
15	39	W	04/17/2019	Part 11: Rolling contact bearings	Shigley 11.1 - 11.5, 3.19
15	40	F	04/19/2019	Part 11: Rolling contact bearings	Shigley 11.6, 11.12
16	41	M	04/22/2019	Part 12: Lubrication	Shigley 12.1, 12.2, 12.4 - 12.6
		Thu	04/25/2019	Final Exam 8:00 am - 10:00 am	