



Department of Mechanical Engineering
ME EN 3000 – Design of mechanical elements – Spring 2021

Syllabus

Instructor:	Prof. B. Raeymaekers , MEK 2676, bart.raeymaekers@utah.edu
Office Hours:	M 1:00-1:30 pm, W 8:30-9:00 am, Th 12:30-1:00 pm, and by appt. Zoom link: https://utah.zoom.us/j/7149075329
Units:	3
Meeting Times:	M, W, F: 9:40 am - 10:30 am, Online (Canvas). I will post a new lecture on Canvas at the regular meeting times.
Engineering Lab:	CADE Lab and Engman Lab
Required notes:	<i>Design of Mechanical Elements, A basic introduction to mechanical design calculations and considerations</i> , B. Raeymaekers (Provided by the instructor on Canvas)
Recommended Text:	<i>Shigley's Mechanical Engineering Design</i> , Budynas & Nisbett The text book is on two-hour reserve at the Marriott Library.
Course Website:	The course content is hosted on CANVAS . All assignments will be submitted, graded, and returned via GRADESCOPE . All students enrolled in the course will automatically be added to Gradescope using their Utah email address (uXXXXXX@utah.edu). All assignments should be scanned and uploaded via the Gradescope website. A step-by-step tutorial is provided here: https://youtu.be/KMPoby5g_nE . It is your responsibility that your scanned assignment is legible; use PDF of a scan, no pictures, images or “CAM2SCAN” apps.
Pre-requisites:	ME EN 2450, 3300 and Upper Division ME Status
Co-requisites:	ME EN 3210, 3650
Course TA:	Karl Niendorf, Quentin Allen

Course summary:

ME EN 3000 is the first course in the Senior Design Sequence - ME EN 3000, 4000, 4010. The course introduces standard mechanical elements that are used in today's engineering world. We arrange the course in twelve different parts:

- Part 1: Introduction to mechanical design
- Part 2: Material selection
- Part 3: Statistical considerations
- Part 4: Tolerances
- Part 5: Design for static strength
- Part 6: Design for fatigue strength
- Part 7: Design of shafts
- Part 8: Design of bolted joints

- Part 9: Design of welded joints
- Part 10: Rolling element bearings
- Part 11: Lubrication

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.

Deliverables and grading:

Homework	25%
Two Midterm exams	2 x 20%
Final exam	35%

The total score s is the weighted average of the homework sets, the midterm exams, and the final exam. A total score s within the intervals shown in the table will guarantee the corresponding letter grade shown, or better.

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

Exams:

- **WHERE:** Download the exam via CANVAS, submit your solution via GRADESCOPE.
- **WHEN:**
 - Midterm exam 1: Fr 02/26/2021, 9:40 am – 10:30 am
 - Midterm exam 2: Mo 03/29/2021, 9:40 am – 10:30 am
 - Final exam: Th 04/29/2021, 8:00 am – 10:00 am

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

- **Specifics:** All exams are “closed book”. Midterm material will be specified in a timely manner. The final exam will be comprehensive. Your exams must be your individual work. You can only use the exam, a scientific (non-programmable/non-graphing) calculator, the unaltered formula sheet provided with the exam, and something to write. The formula sheet is available on Canvas throughout the semester.

Homework:

- **WHERE:** Download the HW via CANVAS, submit your solution via GRADESCOPE.
- **WHEN:** by 5:00 pm on the day the homework is due.
- **HOW:** Using the HW template provided for each HW is mandatory. Your HW should be typed or your handwriting should be legible. The solution method to each problem should be clearly and logically organized. It is your responsibility that the instructor/TA can read, understand, and follow your solution method, and find the answer to each problem. Do not forget to indicate units.

- **Late HW** 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. *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, methodologies, and/or matlab code with others.
- **Partial credit:** Each homework problem contains a “hand in” section that details the intermediate and partial answers for which you need to solve. Partial credit is allotted according to the bullet points specified in the “hand in” section of each homework problem. It is also intended to be a check-list prior to submitting homework.
- **Unforeseen circumstances:** Unforeseen circumstances or events may happen to different students at different times during the semester. To avoid undue impact of these circumstances, we will only count the $(N-2)$ best homework set scores towards the total grade, where $N = 10$ is the total # of homework sets. Thus, the two lowest homework scores will be dropped.

Course material copyright:

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Please see the Code of Student Rights and Responsibilities, Section III.A.5 regarding use and distribution of class Content and materials. <https://regulations.utah.edu/academics/6-400.php> Section III.A.5. prohibits the following: Sale or distribution of information representing the work product of a faculty member to a commercial entity for financial gain without the express written permission of the faculty member responsible for the course. (“Work product” means original works of authorship that have been fixed in a tangible medium and any works based upon and derived from the original work of authorship.)

Academic dishonesty policy:

Engineering is a profession that demands the highest level of personal honesty, integrity, and responsibility. Therefore, it is essential that engineering students, in fulfillment of their academic requirements and in preparation to enter the engineering profession, adhere to the Department of Mechanical Engineering Policy for Academic Misconduct. This policy is based upon the University of Utah’s Policy 6-400: Code of Student Rights and Responsibilities (<https://regulations.utah.edu/academics/6-400.php>) where “Academic misconduct” includes, but is not limited to, cheating, misrepresenting one's work, inappropriately collaborating, plagiarism, and fabrication or falsification of information. It also includes facilitating academic misconduct by intentionally helping or attempting to help another to commit an act of academic misconduct.” Academic misconduct and dishonesty will not be tolerated in this course.

Faculty and student responsibilities:

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	W	01/20/2021	Course intro	
1	2	F	01/22/2021	Part 1: Intro to design	Shigley 1.1 - 1.11, 1.15 - 1.17
2	3	M	01/25/2021	Part 2: Material selection	Shigley 2.1 - 2.11
2	4	W	01/27/2021	Part 2: Material selection	Shigley 2.12 - 2.20
2	5	F	01/29/2021	Part 3: Statistical considerations	Shigley 1.12
3	6	M	02/01/2021	Part 3: Statistical considerations	
3	7	W	02/03/2021	Part 3: Statistical considerations	
3	8	F	02/05/2021	Part 4: Tolerances	Shigley 1.14, 7.8
4	9	M	02/08/2021	Part 4: Tolerances	
4	10	W	02/10/2021	Part 4: Tolerances	
4	11	F	02/12/2021	Part 5: Design for static strength	Review your notes from ME 1300
5		M	02/15/2021	President's Day	
5	12	W	02/17/2021	Part 5: Design for static strength	Shigley 3.1, 3.2, 3.4 - 3.6, 3.8, 3.9
5	13	F	02/19/2021	Part 5: Design for static strength	Shigley 3.10 - 3.13, 3.17
6	14	M	02/22/2021	Part 5: Design for static strength	Shigley 5.1 - 5.5, 5.7 - 5.10
6	15	W	02/24/2021	Part 5: Design for static strength	
6		F	02/26/2021	Midterm 1	
7	16	M	03/01/2021	Midterm 1 overview & discussion	
7	17	W	03/03/2021	Part 6: Design for fatigue strength	Shigley 6.1-6.5, 6.7, 6.8
7		F	03/05/2021	Non-instructional Day	
8	18	M	03/08/2021	Part 6: Design for fatigue strength	Shigley 6.1-6.5, 6.7, 6.8
8	19	W	03/10/2021	Part 6: Design for fatigue strength	Shigley 6.9 - 6.12, 6.15
8	20	F	03/12/2021	Part 6: Design for fatigue strength	
9	21	M	03/15/2021	Part 7: Design of shafts	Shigley 7.1 - 7.4
9	22	W	03/17/2021	Part 7: Design of shafts	Shigley 7.5
9	23	F	03/19/2021	Part 7: Design of shafts	Shigley 7.6, 7.7
10	24	M	03/22/2021	Part 7: Design of shafts	
10	25	W	03/24/2021	Part 7: Design of shafts	
10	26	F	03/26/2021	Part 8: Design of bolted joints	
11		M	03/29/2021	Midterm 2	
11	27	W	03/31/2021	Midterm 2 overview & discussion	
11	28	F	04/02/2021	Part 8: Design of bolted joints	Shigley 8.3 - 8.8
12		M	04/05/2021	Non-instructional Day	
12	29	W	04/07/2021	Part 8: Design of bolted joints	Shigley 8.10, 8.11
12	30	F	04/09/2021	Part 8: Design of bolted joints	Shigley 8.12
13	31	M	04/12/2021	Part 8: Design of bolted joints	
13	32	W	04/14/2021	Part 9: Design of welded joints	Shigley 9.1, 9.2, 9.8, 9.9
13	33	F	04/16/2021	Part 9: Design of welded joints	
14	34	M	04/19/2021	Part 9: Design of welded joints	
14	35	W	04/21/2021	Part 9: Design of welded joints	
14	36	F	04/23/2021	Part 10: Rolling contact bearings	
15	37	M	04/26/2021	Part 10: Rolling contact bearings	Shigley 11.1 - 11.6, 11.12, 3.19
		Mo	05/03/2021	Final Exam 8:00 am - 10:00 am	