Department of Mechanical Engineering
ME EN 3000 – Design of mechanical elements – Spring 2022

Syllabus

Instructor:	**Prof. B. Raeymaekers**, MEK 2676, bart.raeymaekers@utah.edu
Office Hours:	M 12:30-1:00 pm, W 8:45-9:15 am, Th 8:30-9:00 am (Zoom), and by appt. Zoom link: https://utah.zoom.us/j/7149075329
Units:	3
Meeting Times:	M, W, F: 9:40 am - 10:30 am, MEK 3550.
Engineering Lab:	CADE Lab and Engman Lab
Required notes:	*Design of Mechanical Elements, A basic introduction to mechanical design calculations and considerations*, B. Raeymaekers (Provided by the instructor on Canvas)
Recommended Text:	*Design of Mechanical Elements* (available 02/23/22), B. Raeymaekers *Shigley's Mechanical Engineering Design*, Budynas & Nisbett
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:	Sean Detwiler, John Unterhalter

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:** In class.
- **WHEN:**
  - Midterm exam 1: F 02/18/2022, 9:40 am – 10:30 am
  - Midterm exam 2: W 03/30/2022, 9:40 am – 10:30 am
  - Final exam: Tu 05/03/2022, 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	M	01/10/2022	Course intro	
1	2	W	01/12/2022	Part 1: Intro to design	Shigley 1.1 - 1.11, 1.15 - 1.17
1	3	F	01/14/2022	Part 2: Material selection	Shigley 2.1 - 2.11
2		M	01/17/2022	Martin Luther King Jr. Day	
2	4	W	01/19/2022	Part 2: Material selection	Shigley 2.12 - 2.20
2	5	F	01/21/2022	Part 2: Material selection	
3	6	M	01/24/2022	Part 3: Statistical considerations	Shigley 1.12
3	7	W	01/26/2022	Part 3: Statistical considerations	
3	8	F	01/28/2022	Part 3: Statistical considerations	
4	9	M	01/31/2022	Part 4: Tolerances	Shigley 1.14, 7.8
4	10	W	02/02/2022	Part 4: Tolerances	
4	11	F	02/04/2022	Part 4: Tolerances	
5	12	M	02/07/2022	Part 5: Design for static strength	Review your notes from ME 1300
5	13	W	02/09/2022	Part 5: Design for static strength	Shigley 3.1, 3.2, 3.4 - 3.6, 3.8, 3.9
5	14	F	02/11/2022	Part 5: Design for static strength	Shigley 3.10 - 3.13, 3.17
6	15	M	02/14/2022	Part 5: Design for static strength	Shigley 5.1 - 5.5, 5.7 - 5.10
6	16	W	02/16/2022	Part 5: Design for static strength	
6	17	F	02/18/2022	Midterm 1	
7		M	02/21/2022	Presidents Day	
7	18	W	02/23/2022	Part 6: Design for fatigue strength	Shigley 6.1-6.5, 6.7, 6.8
7	19	F	02/25/2022	Part 6: Design for fatigue strength	
8	20	M	02/28/2022	Part 6: Design for fatigue strength	Shigley 6.9 - 6.12, 6.15
8	21	W	03/02/2022	Part 6: Design for fatigue strength	
8	22	F	03/04/2022	Part 6: Design for fatigue strength	
9		M	03/07/2022	Spring Break	
9		W	03/09/2022	Spring Break	
9		F	03/11/2022	Spring Break	
10	23	M	03/14/2022	Part 7: Design of shafts	Shigley 7.1 - 7.4
10	24	W	03/16/2022	Part 7: Design of shafts	Shigley 7.5
10	25	F	03/18/2022	Part 7: Design of shafts	Shigley 7.6, 7.7
11	26	M	03/21/2022	Part 7: Design of shafts	
11	27	W	03/23/2022	Part 7: Design of shafts	
11	28	F	03/25/2022	Part 8: Design of bolted joints	Shigley 8.3 - 8.8
12	29	M	03/28/2022	Part 8: Design of bolted joints	Shigley 8.10, 8.11
12	30	W	03/30/2022	Midterm 2	
12	31	F	04/01/2022	Part 8: Design of bolted joints	Shigley 8.12
13	32	M	04/04/2022	Part 8: Design of bolted joints	
13	33	W	04/06/2022	Part 8: Design of bolted joints	
13	34	F	04/08/2022	Part 9: Design of welded joints	Shigley 9.1, 9.2, 9.8, 9.9
14	35	M	04/11/2022	Part 9: Design of welded joints	
14	36	W	04/13/2022	Part 9: Design of welded joints	
14	37	F	04/15/2022	Part 9: Design of welded joints	
15	38	M	04/18/2022	Part 9: Design of welded joints	
15	39	W	04/20/2022	Part 10: Rolling contact bearings	Shigley 11.1 – 11.5, 3.19
15	40	F	04/22/2022	Part 10: Rolling contact bearings	Shigley 11.6, 11.12
16	41	M	04/25/2022	Part 10: Rolling contact bearings	
		Tue	05/03/2022	Final Exam, 8:00-10:00a	MEK 3550