University of Illinois at Urbana-Champaign
Department of Mechanical Science and Engineering

ME 472 Introduction to Tribology
Spring 2018 - Tentative Syllabus

(Modifications to this syllabus may be required during the semester. Any changes to the syllabus will be posted on the course web site and announced in class.)

1. **Catalog Description**: Friction, wear, and lubrication; engineering surfaces; surface properties and surface topography; Hertzian contacts and contact of rough surfaces; friction of surfaces in contact; wear and surface failures; boundary lubrication; fluid properties; hydrodynamic lubrication; elastohydrodynamic lubrication; bearing selection; introductory micro- and nanotribology. Credits: 3 undergraduate hours. 3 or 4 graduate hours.

2. **Pre-requisites**: Senior or graduate standing

3. **Learning Objectives**: Students will gain a broad knowledge on tribology topics, and be able to do these things, among others:
    a. Speak and write knowledgeably about tribological systems and current issues in the field
    b. Characterize engineering surfaces and use common contact models
    c. Recognize and describe the origins of friction
    d. Analyze wear and surface failures using theory and measurements
    e. Design simple hydrodynamic and hydrostatic bearings
    f. Recognize and explain size effects and scaling in micro- and nano-tribology

4. **Instructors:**

    Alison C. Dunn <acd@illinois.edu>
    - Office hours: TBD

    TA: TBD
    - Office hours: TBD

5. **Meeting Times and Location by Section:**
    - Lecture: Tuesdays & Thursdays 10am-11:50am @ 206 Transportation Building
    - Course Websites: Compass2g <https://compass2g.illinois.edu>
      Piazza <piazza.com>

6. **Textbooks Required**: Engineering Tribology by Stachowiak & Batchelor, 4th Edition or International Edition, electronic or paper **may change**

7. **Recommended Reading**: Course materials outside of the text will be posted on the course website(s), and may include ASTM standards, original research articles, and problem set descriptions

8. **Course Operation**: In order to facilitate learning, a continuum of activities will accompany each topic. A successful student will do the following:

   Before class: Do the assigned reading and participate in the online discussion.

   In class: Take notes during lecture, participate in group exercises, observe demonstrations, and work on projects when applicable.

   After class: Complete problem sets as they are assigned, and complete your project.

9. **Assessment Methods and Grading**: Each student's course score will be calculated as follows:

30%	problem sets (for grad students, includes seminar assignments)
10%	participation (online conversations)
15%	project (report + presentation)
30%	mid-term exams (total of 2)
15%	final exam
100%	**total grade**

   The final exam is optional. If you are satisfied with your grade prior to the final, your grade will be calculated by re-scaling the other components to equal 100%.

   As the majority of activities will take place during class time, attendance is recommended. You may miss up to 2 class sessions with no grade repercussions. Each unexcused absence starting with the third will incur a point deduction from your final grade. Demonstrations during class time at other locations on campus are considered class and have the same attendance rules.

   All graduate students taking the class for 4 credit hours instead of 3 will have additional requirements: additional homework problems, extended project requirements, and attending 2 tribology-related seminars (see Section 12).

10. Assignments:

Reading assignments will be posted a few days before the class meeting, and will be assessed by your online discussion (Piazza).

Problem sets will be posted about a week before they are due, and will be graded according to the correct methods, analysis, and answers. Problem sets should be brought to class on paper, whether you complete them by hand or electronically. These assignments are due at the start of class time.

One project will be assigned near the midpoint of the semester. Some class time will be allotted for working on it, but it should be completed outside of class. The anticipated method of presenting project results is a poster session with instructor and peer review.

Questions regarding grades must be brought to the instructor ***within one week*** after return of the paper to the class.

11. **Seminars:** The University of Illinois brings excellent visitors to campus each semester for seminars. Graduate students must attend at least 2 tribology-related seminars over the course of the semester and write up 1 page on the main content and how it relates to this course content. Undergraduates may earn up to 2 points of extra credit by doing the same (1 point for each seminar). Format: single page, double-spaced prose using font size 12, fill the page.

The seminars listed are known to be tribology-related, though it is not exhaustive. This list will be updated as available, and you may also add to it through Piazza posts to inform the class. You can use any seminar for this, as long as some technical content is tribology-related.

	Speaker and Title: **Prior semester examples**	***Details:***
0	Dr. Jianmin Zuo, Univ of Illinois – title TBD	Wednesday 01/18, 4pm @ Loomis 141 Possible connection: surfaces
1	Dr. John Bush, MIT "Hydrodynamic quantum analogs"	Tuesday 02/07, 3pm @ ESB 190 Possible connection: hydrodynamics
2	Dr. Harley Johnson, Univ of Illinois – title TBD	Thursday 03/02, 12pm @ NCSA 1040 Possible connection: Surfaces and microstructures
3	Dr. Simon Philpott, Univ of Florida – title TBD	Monday 03/13, 4pm @ MSEB 100 Possible connection: tribology simulation
4	Dr. Gerald Fuller, Stanford University – title TBD	Tuesday 03/14, 2pm @ RAL 116 Possible connection: rheology
5	Dr. Katharina Ribbeck, MIT – title TBD	Thursday 04/20, 2pm @ RAL 116 Possible connection: dental/bio tribology
6	Dr. Michael Solomon, Univ of Michigan "Biomechanics of Bacterial Biofilms and its Connection to Bloodstream Infection and Clotting"	Thursday 04/27, 2pm @ RAL 116 Possible connection: complex surfaces and rheology
7		

12. **Make-up Policy:** No late assignments will be accepted. Makeup exams are not normally permitted unless one of the following apply: athlete travel/match, conference/work/interview travel, DRES accommodations, documented illness. If you cannot attend an exam or cannot meet a due date, you must contact the instructor ***prior*** to the exam or due date. Arrangements will be made on a case by case basis. See the college wiki for further information regarding illness: https://wiki.cites.illinois.edu/wiki/display/ugadvise/What+to+Do+If+You+Are+Sick

13. **Academic Integrity** – Students are welcome to use any available resources (library, faculty, computers, etc.) to do problem sets and assigned work. This includes discussions with other students. However, each student must do his or her own write-up for every problem set, unless specified otherwise by the instructor; this includes separate computer programs and output. Students should cite references and resources. If you have any questions on possible areas of confusion (cheating, plagiarism, etc), ask the instructor or see the University's Student Code, Article 1, Part 4. Suspected violations to the Student Code will be addressed formally.

14. **Accommodation for Students with Disabilities** – To obtain disability-related accommodations for this class, students with disabilities are advised to contact the instructor and the Division of Rehabilitation-Education Services (DRES) as soon as possible. To contact DRES, you may visit Beckwith Hall, 201 E. John, Champaign, call 333-4603 (V/TDD), or email <disability@uiuc.edu>.

15. **UIUC Counseling Services** – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

    - UIUC Counseling Center, 610 E John Street, (217) 333-3704, http://www.counselingcenter.illinois.edu/
    - Engineering Career Services, 3270 Digital Computer Lab, (217) 333-1960, http://ecs.engineering.illinois.edu/
    - Local After Hours Crisis Line (217) 359-4141 or text "GO" to 741-741

16. Anticipated Course Calendar:

Week	Dates	Topic	Comments
1	Jan 17/19	Introduction & Engineering Surfaces	
2	Jan 24/26	Contact Between Solids	Problem Set
3	Jan 31/2	Friction	
4	Feb 7/9	Measuring Friction & Uncertainty	
5	Feb 14/16	Frictional Heating	Problem Set
6	Feb 21/23	Project Work	
7	Feb 28/2	Exam 1 (Tues)	
8	Mar 7/9	Wear and Surface Failures (Thurs)	
9	Mar 14/16	Project Presentations, Introduction to Lubrication	Problem Set
10	Mar 21/23	*No class, Spring Break*	
11	Mar 28/30	Lubricant Properties	
12	Apr 4/6	Hydrodynamic Lubrication	Problem Set
13	Apr 11/13	Elastohydrodynamic Lubrication	
14	Apr 18/20	Exam 2 – April 19	
15	Apr 25/27	Biotribology, Tribological Testing	Problem Set
16	May 2	Nanotribology	
17	May 12	Final Exam 8-11 am	