

**DEPARTMENT OF MECHANICAL ENGINEERING**  
**STONY BROOK UNIVERSITY**  
**Design of Machine Elements**

COURSE TITLE: MEC410 Design of Machine Elements, Spring 2021 (3 credits)

PREREQUISITES: MEC310, MEC363

BLACKBOARD <http://blackboard.stonybrook.edu>

LECTURE: 6:05 - 7:20 PM, Mon, Wed; Online via Zoom Meetings

INSTRUCTOR: Jay Mendelson, Professor email: [jay.mendelson@stonybrook.edu](mailto:jay.mendelson@stonybrook.edu)

OFFICE HOURS: Mon 3:45PM - 5:15PM via Zoom Meetings

TA: Zhijie Lyu email: [Zhijie.Lyu@stonybrook.edu](mailto:Zhijie.Lyu@stonybrook.edu) office hours: TBD

Zoom link for lectures:

<https://stonybrook.zoom.us/j/99122218647?pwd=ekhieU4xL081Y2hjTUd0NnBoL2xldz09>

All lectures conveying pure content will be pre-recorded and stored on [www.youtube.com](http://www.youtube.com). The lecture time will involve a class-wide Zoom Meeting, in which students can ask questions about the lecture material or homework problems. Office hours will also be conducted via a weekly Zoom Meeting.

Catalog Data: Application of analytical methods, material science, and mechanics to problems in design and analysis of machine components. Includes the design of mechanical components such as bearings, gears, shafting, springs, fasteners, belts, clutches, and brakes, and takes into consideration factors such as manufacturability and reliability. Design projects with open-ended and interactive problems are assigned to integrate several machine elements in a system.

ASSIGNMENTS: Students will enter numerical answers to homework problems, projects and exams using an online quiz format in Blackboard. For homework problems and projects, they will also upload their spreadsheets to Blackboard, so that the TA can check that the work was done by the student. Homework calculations must be done using a spreadsheet.

*Late assignments will not be accepted.*

TEXT: R. L. Mott, "Machine Elements in Mechanical Design," 6th ed., Pearson, 2018 (ISBN-10: 0-13-4441118-4, ISBN-13: 978-0-13-444118-4)

EXAMINATIONS: 2 Midterms

1 Final, to be scheduled during finals week in May 2021. For the Midterm 1 and 2 and for the Final exams, students will make a scan of the paper exam document they use to calculate their answers, then upload the scanned file to Blackboard.

For each midterm exam you will be allowed four 8.5" x 11" doubled-sided sheets of paper with your *hand-written* notes, as well as copies of figures from the slides and text, and paper copies of *your own* Excel

sheets for homework. You must put your name on the notes and hand them in with your exam. You must use a blue or black pen for writing in your answers. You may *not* enter information in pencil.

For the final exam you will be allowed ten 8.5" x 11" double-sided sheets of paper with your *hand-written* notes, as well as copies of figures from the slides and text, and paper copies of *your own* Excel sheets for homework. You must put your name on the notes and hand them in with your exam. You must use a blue or black pen for writing in your answers. You may *not* enter information in pencil.

You may use an MEC department approved scientific calculator for each exam.

Make-up exams must be arranged prior to the exams. Make-up exam policy is consistent with university policy on:

- (1) Student Participation in University Sponsored Events  
[http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies\\_expectations/participation\\_univspnsored\\_activities.php](http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/participation_univspnsored_activities.php)
- (2) University policy on Final Exams:  
[http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/records\\_registration/final\\_examinations.php](http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/records_registration/final_examinations.php)
- (3) New York State Education Law regarding Equivalent Opportunity and Religious Absences  
[http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies\\_expectations/equivalent\\_opportunity\\_religiousabsences.php](http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/equivalent_opportunity_religiousabsences.php)

Allowed Calculators: Following the Mechanical Engineering Department's mandatory calculator policy, only the following calculators will be allowed to be used on all exams. There will be no exceptions.

- Casio: All FX-115 models. Any Casio calculator must contain FX-115 in its model name.
- Hewlett Packard: The HP 33s and HP 35s models, but no others.
- Texas Instruments: All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

More details are found in the document.



Calculators 2019.pdf

This list of calculators is identical to that allowed for the National Council for Examiners for Engineering and Surveying (NCEES) Fundamentals of Engineering (FE) exam that many of you will take in your senior year, as well as the Professional Engineering (PE) exam that you may take several years from now.

Students are expressly forbidden to upload course materials (exams, lecture notes, homework answer keys) written by the class professor to web sites that store such materials. This is considered a violation of the copyright protection afforded the professor. Examples of web sites include [www.coursehero.com](http://www.coursehero.com), [www.chegg.com](http://www.chegg.com) and [www.study.com](http://www.study.com)

***Academic integrity during the Midterm 2 and Final Exam will be monitored using Respondus Lockdown Browser, which is linked to Blackboard.***

**Instructions for using Respondus Lockdown Software are shown here:**

Respondus Lockdown Browser for students must be downloaded from the Softweb web site per this url:

<https://softweb.cc.stonybrook.edu/>

Once you get to this site, click on Web Browsers, then on Respondus Lockdown Browser. Then click on this link to download the software:

<https://download.respondus.com/lockdown/download.php?id=772113517>

Make sure to read the rules about taking exams that you will see on the same page as the link to download the software. Get Respondus installed on your PC at least 2 days before taking the midterm 1 exam. This will give you time to debug the installation. There will be a unique password to use to make Midterm 1, Midterm 2, and Final Exam. You will need a working Webcam installed on your PC in order to take these exams. This password will be published in a Blackboard Announcement.

**Note the following requirements for your PC to install the Respondus Browser:**

Operating Systems

Windows: 10, 8, 7

Mac: MacOS 10.14 to 10.12, OS X 10.11, OSX 10.10

iOS: 7.0+ (iPad only). Must have a compatible LMS integration. Details.

Chromebook: (K-12 only). Details.

Memory

Windows: 75 MB permanent space on the hard drive

Mac: 120 MB permanent space on the hard drive

Browser Requirements

LockDown Browser is a client application that is installed to a local computer. Both the Windows edition and the Mac edition of the browser are based on Chromium, Google's open source framework. Students do NOT need Google's Chrome browser installed; nor will this version affect a Chrome browser that's already installed.

The web page for installation defaults to download of a Windows based browser. If you need the MAC based browser, click on the link on this icon that says "Do you need the MAC version?".

**Note the following information about Respondus when taking exams:**

Overview of Browser Application:

Respondus LockDown Browser is a client application that is installed to a local computer. Both the Windows edition and the Mac edition of the browser are based on Google's open source Chromium framework. Students do NOT need Google's Chrome browser installed; nor will this version affect a Chrome browser that's already installed.

LockDown Browser creates a "locked" testing environment for Blackboard assessments and includes the following features:

1. Assessments are displayed full-screen and cannot be minimized
2. Assessments cannot be exited until submitted by users for grading
3. Task switching or access to other applications is prevented
4. Printing functions are disabled
5. Print Screen and capturing functions are disabled
6. Copying and pasting anything to and from an assessment is prohibited
7. Right-click menu options are disabled (Windows); key + click options are disabled (Mac)
8. Browser menu and toolbar options are disabled except Back, Forward, Refresh and Stop
9. Function keys (F1-F12) are disabled
10. Source code for the HTML page cannot be viewed
11. URLs cannot be typed by the user
12. Hundreds of screen capture, messaging, screen-sharing and network monitoring applications are blocked from running
13. The browser automatically starts at the institution's login page for Blackboard
14. Links in questions that point to other servers don't compromise the "locked" testing environment
15. Pages from the assessment aren't cached or stored in the browser's history listing

Grading Scale: Semester letter grade is based upon the grading scale for your aggregate grade.

$95 \leq A \leq 100$                        $70 \leq C+ < 75$

$90 \leq A- < 95$                          $65 \leq C < 70$

$85 \leq B+ < 90$                        $60 \leq C- < 65$

$80 \leq B < 85$                          $55 \leq D+ < 60$

$75 \leq B- < 80$                        $50 \leq D < 55$

$0 \leq F < 50$

The aggregate grade is determined from:

Homework assignments 15%

Two Design projects 5% each, 10% total

Two Midterm exams 20% each, 40% total

Final exam 35%

**Note:** Homework and Design projects are done in either MS-Excel or Google Sheets uploaded to Blackboard. The data from certain numbers in the spreadsheets is entered into the automatic grading system in Blackboard.

Your attendance in class is required. ***If you miss 1/3 or more of the classes, you will be penalized one letter grade on your final grade for the class.***



## ABET Course Learning Objectives<sup>1</sup>:

COURSE LEARNING OBJECTIVES	ASSESSMENT TOOLS
1. Know how to design shafts and axles to prevent mechanical failure under a given load.	Exams, Project
2. Know how to analyze clutches and brakes in loaded shafts and axles.	Exams
3. Understand the principles of bolted joints.	Exams, Project
4. Know how to analyze a joint in bending and shear.	Exams, Project
5. Understand the concepts of welded joints and permanent joints.	Exams, Project
6. Know how to design a mechanical spring.	Exams, Project
7. Know how to analyze forces associated with a gear or gear trains.	Exams, Project
8. Know how to size a gear based on bending stress & surface wear.	Exams, Project
9. Know how to design belt transmission system.	Exams
<b>COURSE TOPICS</b>	<ol style="list-style-type: none"> <li>1. Machine Design for Different Types of Loading</li> <li>2. Belt and Chain Drives</li> <li>3. Kinematics of Gears</li> <li>4. Spur Gears</li> <li>5. Helical, Bevel and Worm Gears</li> <li>6. Keys, Couplings and Seals</li> <li>7. Design of Shaft</li> <li>8. Tolerances</li> <li>9. Rolling contact bearings</li> <li>10. Design of a Power Transmission System</li> <li>11. Linear Motion Elements</li> <li>12. Springs</li> <li>13. Fasteners</li> <li>14. Welded and Mechanically assembled frames</li> <li>15. Specification of AC and DC motors</li> <li>16. Design of brakes and clutches</li> </ol>

1. The Bachelor of Science (B.S.) degree program of Mechanical Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

## Course Outline and Assignments:

Note: All events for the Spring 2021 semester will be held online.

wk	dates	Subject	Reading	Misc.
1	2/1-2/3	Introduction; Design for Different Types of Loading	ch 5	Course overview
2	2/8-2/10	Belt and Chain Drives	ch 7	
3	2/15-2/17	Kinematics of Gears	ch 8	
4	2/22-2/24	Spur Gear Design	ch 9	
5	3/1-3/3	Helical Gears, Bevel Gears	ch 10 - part 1	<b>Midterm #1 on chapters 5, 7, 8, and 9: 3/3</b>
6	3/8 - 3/10	Worm Gears, Keys, Couplings, and Seals	ch 10 - part 2, ch 11	
7	3/15 - 3/17	Design of Shafts	ch 12	
8	3/22 - 3/24	Tolerances and Rolling Contact Bearings	ch 13 and 14	
9	3/29 - 3/31	Design of a Power Transmission System and Linear Motion Elements	ch 15 and 17	
10	4/5 - 4/7	Springs	ch 18	<b>Design project I (in lieu of ch 15 homework) due 4/7</b>
11	4/12 - 4/14	Fasteners	ch 19	<b>Midterm #2 on chapters 10, 11, 12, 13, 14, 17, and 18: 4/14</b>
12	4/19 - 4/21	Frames	ch 20	
13	4/26 - 4/28	Motors (AC and DC)	ch 21	
14	5/3 - 5/5	Brakes and Clutches	ch 22	<b>Design project 2 due 5/3</b>
16	5/10-5/19	Study days and Final Exam		<b>Final Exam: 5/12 5:30PM – 8:00PM</b>

## Usage of Blackboard

Students are required to use Blackboard, where important announcements, slides, homework, assignments, and supplementary materials of the course are posted. We will be using the automatic grading capability of Blackboard to grade homework and projects. Anti-plagiarism software will be used to guarantee that all students do their own work in accordance to Stonybrook policies as stated in the section below on **ACADEMIC INTEGRITY**.

<http://blackboard.stonybrook.edu>

Use your NetID and password to login. You can also call the Blackboard Support Team at: 631-632-2777 or e-mail: [blackboard@stonybrook.edu](mailto:blackboard@stonybrook.edu) for further information.

**Important Copyright Notice:** The materials in this course available online through Blackboard or other online channels are for the exclusive use of registered students currently enrolled in this

course, and may not be retained or further distributed. Examples of web sites that distribute student course material include [www.coursehero.com](http://www.coursehero.com), [www.chegg.com](http://www.chegg.com), and [www.study.com](http://www.study.com)

All federal and state copyright interests are reserved for all original material presented in this course through any medium, including lecture, electronic transmission or print. Individuals may not sell, be paid or receive anything of value for class notes made during this course from any person or entity without the express written permission of (author). In addition to legal sanctions, violation of these copyright prohibitions may result in University disciplinary action.

## **Various University Policies and Statements**

**DISABILITY SUPPORT SERVICES (DSS) STATEMENT:** If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website:

<http://www.stonybrook.edu/ehs/fire/disabilities>

**ACADEMIC INTEGRITY STATEMENT:** Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at [http://www.stonybrook.edu/commcms/academic\\_integrity/index.html](http://www.stonybrook.edu/commcms/academic_integrity/index.html)

**CRITICAL INCIDENT MANAGEMENT:** Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

**CLASS ATTENDANCE SCHEDULE:** Students are expected to attend every class, report for examinations and submit major graded coursework as scheduled. If a student is unable to attend lecture(s), report for any exams or complete major graded coursework as scheduled due to extenuating circumstances, the student must contact the instructor as soon as possible. Students may be requested to provide documentation to support their absence and/or may be referred to the Student Support Team for assistance. Students will be provided reasonable accommodations for missed exams, assignments or projects due to significant illness, tragedy or other personal emergencies. In the instance of missed



lectures, the student is responsible for reviewing posted slides, and reviewing recorded lectures. Please note, all students must follow Stony Brook, local, state and Centers for Disease Control and Prevention (CDC) guidelines to reduce the risk of transmission of COVID. For questions or more information click [here](#).