MEC 410: Design of Machine Elements

The State University of New York Korea – Stony Brook University

Spring 2023

INSTRUCTOR	Dr. Jongseong Choi	jongseong.choi@sunykorea.ac.kr	Academic Building B625
TA	TBD	TBD	
CLASSES	TUTH	12:30 – 1:50 pm	B105 & online
OFFICE HOURS	TU	2:00 - 3:00 pm, or by appointment	B625

COURSE TEXTBOOK

Shigley's Mechanical Engineering Design, R. G. Budynas and J. K. Nisbett, McGraw-Hill Education, 11th ed. in SI units, 2021, ISBN 978-981-315-898-6

PREREQUISITE

MEC310; MEC 363

ASSIGNMENTS

As basic preparation for each lecture, you should read the assigned material before coming to class. Inclass discussion and examples are designed to help prepare you for homework assignments. In addition to the reading and homework assignments, you should review your past class notes on a daily basis.

Homework: Individual homework is assigned weekly throughout the semester. They will be given every <u>Tuesday</u>. Homework assignment should be scanned and submitted through the new online education platform Brightspace (<u>https://mycourses.stonybrook.edu/d2l/home</u>) before <u>Thursday at 11:59 pm</u> of the following week. You can drop one worst score at the end of the course. The detailed course schedule is provided in the following pages of '**Course Schedule**'.

EXAMINATION

There are two <u>midterm examinations</u> and one comprehensive <u>final examination</u>. For all examinations, you can bring one sheet (both sides) for equations and notes. You can bring your TI-30X calculator, pencil(s), and eraser. The use of smartphones, laptop, iPad, or any other sources of communication is strictly prohibited. For the grading, point deduction will occur when you do not represent: the <u>engineering approach</u>, <u>free body diagram (FBD)</u>, <u>list of assumptions and equations</u>, <u>and sufficient details of the solution</u>. Problem solution format will be provided in detail on the following page.

COURSE GRADING

Homework & Attendance	15%
Midterm #1	25%
Midterm #2	25%
Final Exam	35%
TOTAL	100%

Grading will be curved and normalized to 100% then given in a scale of:

$92 \leq A$	< 100	$74 \leq$	C+	< 78
$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	< 92 < 88	$70 \leq 67 \leq$	C C-	< 74 < 70
$81 \leq B$	< 85	$64 \leq 60 \leq 60$	D+	< 67
/8 ≤ B-	< 81	$60 \leq$	D	< 64

COURSE OVERVIEW

Application of analytical methods, materials science, and solid mechanics to problems in design and analysis of machine components. Includes the design of mechanical components such as shafts, screws, fasteners, mechanical springs, rolling-contact bearings, spur and helical gears, clutches, brakes, couplings, flywheels, and power transmissions.

CO	URSE LEARNING OBJECTIVES	ASSESSMENT TOOL
1.	Cover the basics of machine design, including the design process, engineering mechanics and materials, failure prevention under static and variable loading, and characteristics of the principal types of mechanical elements.	Exams/ Homework
2.	Offer a practical approach to the subject through a wide range of real- world applications and examples.	Exams/ Homework
3.	Encourage readers to link design and analysis.	Exams/ Homework
4.	Encourage readers to link fundamental concepts with practical component specification.	Exams/ Homework

COURSE TOPIC

1.	Materials
2.	Load and Stress Analysis
3.	Deflection and Stiffness
4.	Failures Resulting from Static Loading
5.	Fatigue Failure Resulting from Variable Loading
6.	Shafts and Shaft Components
7.	Screws, Fasteners, and the Design of Permanent Joints
8.	Mechanical Springs
9.	Rolling-Contact Bearings
10.	Gears – General
11.	Spur and Helical Gears
12.	Clutches, Brakes, Couplings, and Flywheels
13.	Power Transmission Case Study
14.	Geometric Dimensioning and Tolerancing

BLACKBOARD switching to Brightspace

All homework assignments and solutions will be posted on the new online education platform Brightspace (<u>https://mycourses.stonybrook.edu/d2l/home</u>). For problems logging in, go to the coordinator of the department. It is your responsibility to make sure that you can access the Brightspace system. We will have a practice session, Use of Brightspace, in our first class on Aug 30.

ACADEMIC HONESTY

The campus policies on academic honesty are available on the Web (http://naples.cc.sunysb.edu/CAS/ajc.nsf/pages/info). Academic dishonesty is an extremely serious offense and will not be tolerated in any form. Academic dishonesty in general is the presentation of intellectual work that is not originally yours. Examples include, but are not limited to, copying or plagiarizing class assignments including homework, reports, and other submitted materials; copying or otherwise communicating answers on exams with other students; bringing unapproved aids, either in physical (written) or electronic form to an exam; obtaining copies of an exam prior to its administration, etc. Academic dishonesty violates both the ethical and moral standards of the Engineering profession and all infractions related to academic dishonesty will be prosecuted. Faculty members are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website: http://www.stonybrook.edu/commcms/academic_integrity/index.html

SPECIAL NOTE ON ADA

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact One-Stop Service Center, Academic Building A201, (82) 32-626-1117. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

CRITICAL INCIDENT MANAGEMENT STATEMENT

The State University of New York, Korea expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

ATTENDANCE POLICY of SUNY KOREA

- 1. All students of SUNY Korea are required to attend every class.
- 2. Unexcused absences will affect seriously the student's final grade in the course.
- 3. If a student has over 20% unexcused absence, the student's final course grade will be an 'F'.
- 4. Students should report the reason of absence to the instructor in advance, or immediately after the absence.
- 5. When a student excuses his/her absence, the student must provide documentation of the reason for the absence to the instructor.
- 6. The instructor of the course reserves the right to excuse absences.
- The course instructor may excuse the absence if the submitted documentation fulfills the conditions below. • Extreme emergencies (e.g. death in the family) • Severe medical reasons with doctor's note (Not a slight illness) • Very important events (e.g. national conference, official school event)
- 8. At the end of semester, the course instructor should submit a copy of the attendance sheet to the Academic Affairs Office.

PROBLEM SOLUTION FORMAT

For both homework and examination, use empty A4-size paper, only one side and only one problem per page. If more than one page is needed for a problem, all pages must be transmitted in order. At the top of the paper, you write the following information from left:

Your name	Student ID number	Problem number	Page number
(first, last)		(i.e. HW1, HW2,)	(i.e. 1/3, 2/3, 3/3,)

Then, provide the information listed below:

Find: List what the problem wants you to find. You use this information to decide on the system you'll be analyzing, and how you'll sketch the appropriate energy flow diagram. This information will also drive your choice of basic equation(s) for problem solution since the one(s) you chose must include the quantity (or quantities) of interest.

Free Body Diagram (FBD): Your Free Body Diagram (FBD) will identify your system. Your FBD will guide your choice of terms in the basic equations that you keep or reject.

Given: Given information serves three purposes. First, it helps you determine which terms in your basic equations you can settle on immediately. Second, it helps you determine how many basic equations you need—the number of basic equations must equal the number of unknowns. Third, it provides guidance for constructing your FBD.

Assumptions: Assumptions are listed to help you eliminate terms in your basic equations. e.g. "Steady state," "Uniform flow," "Ideal gas," etc.

Solution: This includes correct units.

Course Schedule MEC 410: Design of Machine Elements

The State University of New York Korea – Stony Brook University Spring 2023

Lecture	Day	Date	Location	Торіс	Chap.	HW given	HW due
1	TU	Feb 28	B105	Syllabus; Basic concept; Intro to Mech Eng Design	Ch.1		
2	TH	Mar 2	B105	Independence Movement Day: No classes in session		HW #1	
3	TU	Mar 7	B105	Materials	Ch.2		
4	TH	Mar 9	B105	Load and Stress Analysis	Ch.3	HW #2	HW #1
5	TU	Mar 14	B105	Deflection and Stiffness	Ch.4		
6	TH	Mar 16	B105	Deflection and Stiffness	Ch.4	HW #3	HW #2
7	TU	Mar 21	B105	Failures Resulting from Static Loading	Ch.5		
8	TH	Mar 23	Online or make-up	Special Session – Stress & Strain Transformation	-	HW #4	HW #3
9	TU	Mar 28	B105	Failures Resulting from Static Loading	Ch.5		
10	TH	Mar 30	B105	Failures Resulting from Static Loading	Ch.5	HW #5	HW #4
11	TU	Apr 4	B105	Practice Exam			
-	TH	Apr 6	B105	Midterm #1 – No class			HW#5
12	TU	Apr 11	B105	Review of Midterm#1; Fatigue Failure Resulting from Variable Loading	Ch.6		
13	TH	Apr 13	B105	Fatigue Failure Resulting from Variable Loading	Ch.6	HW #6	
14	TU	Apr 18	B105	Shafts and Shaft Components	Ch.7		
15	TH	Apr 20	B105	Screws, Fasteners, and the Design of Nonpermanent Joints	Ch.8	HW #7	HW #6
16	TU	Apr 25	B105	Screws, Fasteners, and the Design of Nonpermanent Joints	Ch.8		
17	TH	Apr 27	B105	Mechanical Springs	Ch.10	HW #8	HW #7
18	TU	May 2	B105	Mechanical Springs	Ch.10		
19	TH	May 4	Online or make-up	Practice Exam			HW #8
-	TU	May 9	B105	Midterm #2 – No class			
20	TH	May 11	B105	Review of Midterm#2; Gears – Rolling-Contact Bearings	Ch.11	HW #9	
21	TU	May 16	B105	Rolling-Contact Bearings	Ch. 11		
22	TH	May 18	B105	Gears – General	Ch.13	HW #10	HW #9
23	TU	May 23	B105	Spur and Helical Gears	Ch.14		
24	TH	May 25	B105	Clutches, Brakes, Couplings, and Flywheels	Ch.16	HW #11	HW #10
25	TU	May 30	B105	Power Transmission Case Study	Ch.18		
26	TH	Jun 1	B105	Practice Exam			HW #11
-	TU	Jun 6		Memorial Day- No class			
-	TH	Jun 8		Reading Day – No class			
-		TBD	TBD	Final Examination			