SYLLABUS
MENG 4134 - 101: Machines Elements Design
(Required Course)
Fall 2025

Instructors: Lecture: Dr. Salim Azzouz, Labs: Dr. Pranaya Pokharel

Office No. & Phone: MY 219 G - (940)-397-4301 (Azzouz), MY 219 C, (940) 397-4289 (Pokharel)

E-mail: salim.azzouz@msutexas.edu, pranaya.pokharel@msutexas.edu

Office Hours: See schedules on D2L and Offices doors. All other times by appointment.

Lecture Schedule: MWF 8:00 - 8:50 AM. Lab. Schedules: 11A: T, 11:00 am to 12:50 am,
11B: T 1:00 pm to 2:50 pm, 11C: T 3:00 pm to 4:50 pm. Locations: MY 136/MY 121

CATALOG DESCRIPTION
Load and stress analysis of mechanical elements; materials failure theories; power transmission; design of machine elements such as: shafts, permanent joints; mechanical springs; rolling contact bearings; journal bearings; gears, belts, and flywheels. Companion lab.

COURSE PRE-REQUISITES
MENG 3233 Mechanisms & Dynamics of Machines.

OTHER PREREQUISITES
Basic computer skills, SolidWorks, SolidWorks Simulations, MATLAB, MS Excel, hand calculator.

TEXTBOOK
Shigley's Mechanical Engineering Design. *Nisbett 99e: Shigley's Mechanical Engineering Design: 2024 Release Loose-Leaf for Fall 24., ISBN-9781266731716, Publisher McGraw Hill Education.*

OPTIONAL TEXTBOOK
Machine Elements in Mechanical Design, *Robert L. Mott, 6th edition, ISBN-13-978-0134441184, Publisher Pearson Editions.*

REFERENCES
Additional material will be posted in D2L.

TOPICS COVERED

Topics	Topics
Load and Stress Analysis	Mohr's Circles
Shocks and Impacts	Failure theories
Shaft Design	Power Screws
Welding	Mechanical Springs
Rolling-Contact Bearings, Lubrication and Journal Bearing	Gears, Spur and Helical Gears, Bevel and Worm Gears
Belts	Power Transmission
Finite-Elements Analysis	

COURSE LEARNING OBJECTIVES AND RELATIONSHIP TO PROGRAM EDUCATIONAL OUTCOMES

Outcome-Related Course Learning Objectives	1	2	3	4	5	6	7
Understand and apply the method of sections to analyze internal forces in beams	X	X		X			
Understand and apply the failure criteria for ductile materials	X	X					
Understand the steps involved in designing a shaft using the stress failure criteria	X	X					
Understand the different types of stress involved in dimensioning power screws	X						
Understand and determine the average shear stress in fillet welds	X	X					
Estimate the torsional yield strength of a helical compression spring wire	X	X					
Determine a bearing load life based on a rated reliability	X	X					
Understand how is the Petroff equation for a journal bearing is derived	X						
Determine a shaft bearing loads for spur and bevel gears	X	X					
Understand how is the Lewis equation for estimating the bending stress in a gear tooth is derived	X	X					
Estimate the centrifugal tension force and torque experienced by a transmitting power flat belt?	X	X					
Understand how can the Finite Element Method be used, and applied for stress analysis in mechanical structural parts	X	X					
Practice how to write formal and informal engineering reports			X	X	X		X
Experience how can you effectively work as a part of a team			X	X	X		X

1: an ability to identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics
2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental, and economic factors
3: an ability to communicate effectively with a range of audiences
4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5: an ability function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions
7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

CONTRIBUTION OF COURSE TO PROFESSIONAL COMPONENT
This course contributes to the engineering science component of the mechanical engineering program.

COURSE ORGANIZATION AND ASSESSMENT

- **Course**

  Format and Content: This course will be delivered in person at the McCoy School of Engineering. Classes meet MWF for 50 minutes. Lectures will focus on key concepts from the textbook and the solution of selected case problems. Not all material will be covered in class; students are responsible for reviewing the assigned textbook sections independently to strengthen their understanding.

  Attendance and Conduct Regular attendance are required and will be recorded each session. Students are expected to act with professionalism and respect at all times. Phones, laptops, and other electronic devices are strictly prohibited under any circumstances.

  Disruptive Behaviors: Inappropriate behavior in class such as disruptive talking, sleeping, eating, or drinking are not allowed, working on non-course related tasks, or watching videos on cellphones or laptops will be considerably detrimental to the student's overall grade. Repeated absences, tardiness, or disruptive conduct may result in withdrawal from the course.

  Participation: Active participation in discussions and problem-solving activities is encouraged and will be reflected in the final grade.

  Why The Above Expectations Matter: Students are expected to remain attentive. These guidelines are in place to ensure a respectful and focused learning environment where every student can fully benefit from the course.

- **Exams**

  There will be two regular exams and a final exam at the end of the semester. Each exam will include the following, a) theoretical questions based on the textbook, designed to assess the students' ability to independently acquire and understand the course material, b) practical questions aimed at evaluating students' skills in analyzing, thinking critically, and solving engineering problems. Each exam will cover the course material taught prior to the first exam or between two consecutive exams. All exams will be conducted in class. Solutions must be written on the front side of the engineering paper or blank sheets only; the back side should not be used. Answers should be clearly organized, with proper question numbering, and neatly presented. During the exam, each student may use, 1) a single-page course summary sheet with writing on both sides, 2) a hard copy of the assigned textbook, 3) the instructor notes, and 4) a copy of their homework solutions. No other materials are permitted during the exam. It is mandatory to take the exam on the scheduled date and time. If, for any unexpected or unforeseen reason, a student misses an exam, he/she must provide valid and convincing documentation explaining his/her absence. If the instructor agrees to take the documentation, and depending on his availability, a make-up exam will be prepared and administered on a mutually agreed upon date. The student has to be aware that the make-up exam may differ significantly from the regular exam. During the exam, the use of cell phones or any other electronic devices is strictly prohibited, except for a basic hand-held calculator. All cell phones and electronic devices will be collected at the beginning of the exam and returned at the end.

- **Homework**

  Homework assignments will be posted on D2L Dropbox from selected chapters chosen by the instructor. All assignments must be completed using the mandatory homework template, available on D2L. Students are required to submit homework as a single PDF file uploaded to the designated D2L Dropbox. Any other file formats will be dismissed. Each submission must include: 1) the official homework question sheet as a cover page, 2) a clearly organized solutions with proper question numbering, and 3) neatly and legibly written work that follows the template guidelines. Homework is due on the date specified on the assignment sheet. Failure to submit homework will negatively impact the student's participation/attitude grade. Late submissions will be accepted until the end of the semester but will receive a maximum grade of 50%. Every student must submit their own original work written in their own words. Duplicate, shared,

or group submissions are not allowed unless explicitly authorized by the instructor. Certain assignments may require the use of MATLAB software. The homework is graded according the following rubric:

The homework was completed thoroughly, with detailed figures and accurate calculations. The student demonstrated significant personal effort in clearly explaining the solutions and showed creativity and ingenuity in problem-solving.	90%-100%
The homework contains numerous calculations with only a few minor mistakes or omissions. Some details are missing, but the student demonstrated personal effort in explaining and completing the assignments.	80%-89%
The homework is incomplete, with several problems or questions unanswered. Some results are incorrect, and the submission lacks sufficient explanations and detailed calculations. Overall, the work is superficial, and the student did not demonstrate genuine effort to complete the assignment.	70%-79%
The homework is entirely incomplete and poorly presented, with many problems and questions unanswered. Most results are incorrect, and the student did not demonstrate any effort to complete the assignment. The submission also lacks critical details.	50%-69%
Homework not uploaded to D2L	0%

- **Lab Reports**

  In addition to the weekly three-hour lectures, two hours will be dedicated to lab experiments, result analysis, and lab report preparation. Lab reports are based on the material studied in class or presented as a course complement during the lab sessions. Organized and neat lab reports must be submitted on the due date at the beginning of class. Each group of students is responsible for submitting their own report in their own words. A student who was absent during a lab session cannot add their name to that lab group's report. Labs are graded according to the rubric provided in the table below. Students are encouraged to complete their lab work and submit it during the lab session whenever possible. Arriving late to the lab or leaving a lab session without the instructor's authorization will result in a penalty to the student's general attitude grade. For detailed lab guidelines, content, scheduling, and policies on late submissions, students should refer to the lab instructor: Dr. Pranaya Pokharel.

Submitted/Behavior	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0
Motivation	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0
Lab Theory	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Lab Procedure	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0
Results and Discussion	30	28	26	24	22	20	18	16	14	12	10	9	8	7	6	5	4	3	2	1	0
Conclusion	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0
Ref./Org./Neatness	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0

- **Course Grade**

Students will be graded individually; no collective grades will be assigned for any of the listed graded items, except for lab work. The final course grade will be based on the scores earned in the three mandatory exams, the average score of homework, the average score of lab reports, and the general student attitude grade. The contributions to the final grade are as follows:
The first exam (10%), the second exam (25%), the third exam (35%), homework average (10%), lab reports average (10%), and class participation, returned assignments' neatness, student behavior, attitude, and class attendance (10%), for a total of 100%. The overall course average (X) is calculated as follows:
X = 10% Exam 1 + 25% Exam 2 + 35% Final Exam + 10% Homework + 10% Lab Reports + 10% Participation/Behavior/Attendance/Ethics.
The final letter grade for the course is based on the value of X and is determined from the following grade ranges table:

Value Range of X (in %)	Letter Grade
$90 \leq X \leq 100$	A
$80 \leq X < 90$	B
$70 \leq X < 80$	C
$60 \leq X < 70$	D
< 60	F

CONFLICT RESOLUTION

If a misunderstanding or a conflict arises between the student and the instructor. Please follow this conflict resolution procedure:

1) The student should contact the instructor face to face or via e-mail if there is an issue with the course or the instructor. The faculty and the student will discuss this face to face or via email. Hopefully a resolution is reached on the issue.
2) The student should notify the faculty via email again if the issue still did not get resolved after the first encounter or communication.
3) The student can then contact the Chair of the McCoy School of Engineering, Dr. Raj Desai, face to face or via email, (raj.desai@msutexas.edu), and discuss this issue. Dr. Desai will discuss the issue at hand with the faculty member. Dr. Desai will discuss the result of this discussion with the student. Hopefully a resolution is reached on the issue after this.
4) The student should notify the Chair via email if the issue still did not get resolved.
5) The Chair will contact the Dean and try to resolve the conflict. In case the conflict deals with the student grade, the Dean will forward the case to the Grade Appeals Committee if necessary.

GENERAL GUIDELINES

- Plan to spend at least 6 hours outside of class to study the material and to work on homework assignments, and lab experiments. Do not wait until the last day to start working on your homework, lab report, or prepare for the exam.
- Read and understand the course material after class, or at least review the course material before coming to class.
- Utilize the instructor office hours throughout the semester to seek explanations from him.
- Use the template with engineering or blank paper for all homework assignments. Use the blank sheets provided by the instructor for the exams. In engineering, neatness is a must, not a luxury. Be advised that you will be penalized for a lack of neatness.
- Use a systematic approach to solve problems. If a problem involves drawing a graph, use Excel, MATLAB, or any other graphic software tool to draw the graph.
- You are strongly encouraged to study in-group. Time to time a lab partner will be randomly selected for you.

UNDERGRADUATE GENERAL RESEARCH INFORMATION

EURECA

Enhancing Undergraduate Research Endeavors and Creative Activities (EURECA) is a program that provides opportunities for undergraduates to engage in high-quality research and creative activities with faculty. EURECA provides incentives and funding through a system that supports faculty and students in a cooperative research process. For more information contact the Office of Undergraduate Research, (940) 397-6275 or by sending a message to eureca@msutexas.edu or better yet, stop by the Undergraduate Research office located in the atrium of the Clark Student Center, room 161. Information and resources are available at www.msutexas.edu/eureca.

UGROW

Like EURECA, the Undergraduate Research Opportunities and Summer Workshop, UGROW provides opportunities for students to conduct research with faculty. However, the research occurs in the summer. For five weeks, UGROW students experience the authenticity of scientific research in faculty's laboratories, in a highly interdisciplinary environment. Students work on projects of their choice and present their findings at the end of program and the MSU Undergraduate Research Forum. Faculty members publicize research projects in the spring. The application deadline for UGROW 2025 has not been established yet; however, it will be announced in the upcoming spring semester. Information and resources are available at www.msutexas.edu/ugrow.

PROPOSED EURECA OR UGROW PROJECTS

The current faculty - Dr. Salim Azzouz - has several proposals for EURECA or UGROW projects. The proposed projects are the following:

- Biomimicry - Calculating the mathematical surfaces shown in a seashell fossil patterns
- Aeronautics - A feather based vertical take-off aircraft
- Energy - A gravity based solar public night light
- Energy - Desalinating water using wind or solar energy
- Energy – Designing new types of vertical wind turbines
- Materials Science - Determining the chemical composition of various collected rocks, and the processes to extract their basic components
- Materials Science: Testing different manufacturing processes to cut and polish rocks
- Numerical Methods: Using the Finite Elements Method to solve real structural engineering problems

If you are interested in working on any of the above projects through the EURECA or UGROW undergraduate research programs, please contact Dr. Azzouz directly.

Council on Undergraduate Research (CUR)

To support undergraduate research and creative activities, Midwestern State University holds an enhanced institutional membership with the Council on Undergraduate Research (CUR). This institutional membership includes unlimited memberships for any interested faculty, staff, and students. Students may find information on benefits and resources at:
https://www.cur.org/engage/undergraduate/.

The CUR Undergraduate Resources Webpage contains:

- Research Opportunities
- Presentation Opportunities
- Undergraduate Research Journals

- CUR-Sponsored Student Events
- and more!

MIDTERM PROGRESS REPORT
In order to help students, keep track of their progress toward course objectives, the instructor for this class will provide a Midterm Progress Report through WebWorld for at-risk students. Midterm grades will not be reported on the students' transcript; nor will they be calculated in the cumulative GPA. They simply give students an idea of where they stand at the midpoint of the semester. Students earning below a C at the midway point should have a meeting with the professor and seek out tutoring. Please visit: https://msutexas.edu/academics/tasp/.

CAMPUS CARRY STATEMENT
Senate Bill 11 passed by the 84th Texas Legislature allows licensed handgun holders to carry concealed handguns on campus, effective August 1, 2016. Areas excluded from concealed carry are appropriately marked, in accordance with state law. For more information regarding campus carry, please refer to the University's webpage at http://msutexas.edu/campus-carry/rules-policies.

GENERAL EDUCATION STATEMENT
Students in this course must demonstrate their competency in oral and written communication through written homework assignments, lab reports, and exams. They must also demonstrate their ability to use the English language.

ACADEMIC INTEGRITY POLICY AND ETHICS
Scholastic dishonesty will not be tolerated and will be prosecuted to the fullest extent. You are expected to have read and understood the current issue of the student handbook:
https://msutexas.edu/student-life/_assets/files/handbook.pdf.
regarding student responsibilities & rights, and the intellectual property policy information about procedures and what constitutes acceptable on-campus behavior. Any form of plagiarism will not be accepted, and will be heavily reprimanded. For more information, please visit the MCOSME student resources website: https://msutexas.edu/academics/scienceandmath/student_resources.php.

Since writing, analytical, and critical thinking skills are part of the learning outcomes of this course, all writing assignments should be prepared by the student. Developing strong competencies in this area will prepare you for a competitive workplace. Therefore, AI-generated submissions are not permitted and will be treated as plagiarism.

DISABILITY SUPPORT SERVICES
Students registered with Disability Support Services should have a letter verifying their disability and the appropriate accommodations.

DISCLAIMER STATEMENT
Information contained in this syllabus, other than grading, late assignments, makeup work, and attendance policies, may be subject to change with advance notice, as deemed appropriate by the instructor.

Prepared by: Dr. Salim Azzouz and Dr. Pranaya Pokharel, *Date*: 08/15/2025