SYLLABUS
MENG 4143 – 101: Senior Design I
Required Course - Fall 2024

Instructors: Dr. Salim Azzouz, Dr. Sheldon Wang, Dr. Jan Brink, Dr. Yu Guo, Dr. Zeki Ilhan, Dr. Mahmoud Elsharafi and Dr. Pranaya Pokharel.

Instructors offices No: MY 219G, MY 138, MY 137, MY 219A, MY 219E, MY 219F, and MY 219C.

Main Intructor: E-mail: salim.azzouz@msutexas.edu, Tel.: (940) 397-4301

Office Hours: See schedules displayed on D2L, other days and times by appointment.

Lecture Schedule & Location: Lecture W **1:00 - 1:50 PM**, MY 136, Dr. Salim Azzouz.

Lab Section, Instructors, Locations & Schedules:

Session	Instructor	Room	Time	Session	Instructor	Room	Time
11A	S. Azzouz	MY 136	W 2:00 - 5:50 PM	11E	Z. Ilhan	MY 125	W 2:00 - 5:50 PM
11B	S. Wang	MY 131	W 2:00 - 5:50 PM	11F	M. Elsharafi	MY 123	W 2:00 - 5:50 PM
11C	J. Brink	MY 118	W 2:00 - 5:50 PM	11G	P. Pokharel	MY 121	W 2:00 - 5:50 PM
11D	Y. Guo	MY 140	W 2:00 - 5:50 PM				

CATALOG DESCRIPTION
Coursework emphasizes creative and critical thinking, planning, design, execution, and statistical evaluation of experiments, teamwork, and project management. This course integrates knowledge gained from most of the required courses in a major design project. Students will design, build, and formally present their completed projects to a panel of professional reviewers. Students will ideally work on projects from local industry. If not available, the students or instructor may propose projects.

COURSE PREREQUISITES
Completion of all required MENG 3000 level courses or permission of instructor.

OTHER PREREQUISITES
Basic computer skills, MATLAB, SolidWorks, SolidWorks Simulation, LabVIEW, Automation Studio, MS Word, MS Excel, hand calculator.

OPTIONAL TEXTBOOKS
Shigley's Mechanical Engineering Design. *Nisbett 99e: Loose-Leaf for Fall 24., McGraw Hill Education.*
Engineering Design, *By George E. Dieter, 6th edition, McGraw Hill Education.*
Materials Science and Engineering, an Introduction, *by William D. Callister, 10th edition, John Wiley.*

REFERENCES
Additional material will be provided in D2L.

TOPICS COVERED

Topics	Topics
Teamwork	Machining Processes
Brainstorming and Creativity	Manufacturing Processes
Engineering Design	Project Management

COURSE LEARNING OBJECTIVES AND RELATIONSHIP TO PROGRAM EDUCATIONAL OUTCOMES

Outcome-Related Course Learning	1	2	3	4	5	6	7
Work as team			X	X	X		
Explain the four fundamental brainstorming principles	X	X			X		
Explain the five mental steps leading to creative processes	X	X		X			
Lay down the seven steps of the engineering design process	X	X	X	X		X	X
Describe the machining operation done on a lathe		X				X	
Describe the machining operations done on a milling machine		X				X	
Explain the investment casting process		X	X	X		X	
Lay down the detailed design of a mechanical part (shaft example)	X	X					
Use the five processes involved in a project management			X	X			
Write formal and informal engineering reports	X	X	X	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 STUDENT PERFORMANCES ASSESSMENT

General Information

This course provides the students with the opportunity to work in an environment which closely simulates a real workplace environment. The students will work in groups composed of two or three members from diverse backgrounds, with diverse skills and capabilities. Each senior design group of students is required to elect a spokesman leader, a treasurer, and a report organizer. The projects are devised by the faculty or the industry and assigned to the students in the first week of the fall semester. Each faculty will provide the students with a general project description sheet and main goals to achieve. Throughout the senior design I+II semesters, each group will carry-out a set of project phases ranging from a brainstorming phase, a product design and fabrication phases, and a final testing phase.

Brainstorming Phase

Within the first few weeks after the starting of the fall semester, by a date specified by the instructor toward the end of September, each group will submit a proposal report about its assigned senior design project and give an internal oral presentation. The report and the oral presentation feature the outcomes of the brainstorming sessions done by the group during the aforementioned period and articulate the adopted project design concepts.

Preliminary Design Calculations and Drawings for Parts and Assemblies

Based on the design concept outlined in the previous phase a defined set of preliminary design calculations and drawings for the parts and assemblies are required for this step. By a date specified by the instructor toward mid-October, each group through an oral presentation will present and submit to the instructor a draft set of the preliminary design calculations and drawings for parts and assemblies.

Final Draft Proposal Report with Budget, Quotes, and Timeline

Toward the end of the semester, each group will submit a final major draft proposal report containing the final design, calculations, drawings for parts and assemblies with budget, ordered parts, quotes for last parts, realization timeline, references, and appendices. The instructor will review the draft proposal report, write his own final recommendations for the final report, and turn it to the students. The students have to adjust the proposal report according to the recommendations of the instructor. A general template of the proposal report will be uploaded to D2L as must follow guidance report for the students.

Guidelines for the Students

1. The faculty mentor in charge of supervising the students and the project advancement is there to guide the students, advise them, and evaluate their effective contribution to the senior design project. The faculty mentor is not there to do the students' work. The faculty mentor expects the students to behave professionally and ethically throughout the duration of the project. After class course starts, the use of cellphones, laptops, or any other electronic devices is strictly prohibited. Any student caught misbehaving in class, using foul language, making unethical written or verbal derogatory remarks about their classmates or the instructors, conducting private and/or loud conversations during class, working on anything that is not directly related to the course, playing, watching games or movies, drinking, eating or sleeping in class, leaving the class without the express permission of the instructor will result in heavy penalties for the student attitude grade (20%). Additionally, if the student intentionally slows down the normal pace of the project, do not turn-in his/her weekly report, logbook, and homework on regular basis, show a lack of respect to their teammates by unfairly dismissing their ideas, not listening to them, not communicating with them, and not attending the group outside meetings, such behavior will

result in heavy penalties for the student attitude grade as well. If the above infractions are continuously repeated by the student, the instructor will drop the student from class and labs for the rest of the semester. Not attending or arriving late to scheduled lectures, labs, and group/faculty meetings may cost the student the full attitude & absenteeism & project contribution & sharing knowledge with teammates and faculty mentor & attending group meetings & ethical behavior grade (20%).

2. It is brought to the attention of the student that the stated deliverable at the beginning of the semester might be changed by the instructor, depending on the project advancement, and/or unforeseen encountered difficulties and problems during the project.

3. It is brought to the attention of the students that each one of them is expressly required to participate in all internal, external, partials, and finals senior design presentations.

4. It is brought to the attention of the students that any changes in the project design and drawings discussed with other faculty members, engineers and technicians from sponsoring company, the department machinist technician, and the department lab technician must be reported immediately to the instructor in charge of the group who will decide on whether to adopt these changes or not.

5. It is brought to the attention of the students that each final drawing and the manufacturing process of a machine part has to have the approved signature of the instructor in charge of the group.

6. It is brought to the attention of the students that each purchase of a machine part has to have the approved signature of the chair of the department, the instructor in charge of the group, the machinist, and the purchaser. The three signatures as well as the current budget have to be clearly shown on any purchase request. All purchases have to stay within the allowed budget which is $2,000/group.

Lecture, Exams, Logbook Homework, and Laboratory

This course consists of a one-mandatory hour lecture and four mandatory-hour laboratory design/manufacturing sessions per week. The one-hour lecture session includes mostly a talk by the instructor, and sometime a general discussion of the project's progression (weekly assignments, difficulties, needs, and encountered issues). The lab time will be spent by the groups working on their projects on their own and under the supervision of their faculty mentor and when needed the machinist technician or the external company engineer (s) or technician (s). Time will be taken during the lab sessions by the machinist to demonstrate some of the main machining operations. The students are required to attend the whole lab session each Wednesday from 2:00 pm to 5:50 pm, and wait for their turn to meet with their faculty mentor. It is brought to the attention of the students that the lab-time is not sufficient to complete all the required weekly tasks. The students have to manage their own study schedule and find time for meetings to complete all required tasks.

The final exam will be in-person, face-to-face, and based on the materials studied and videos seen during the class lecture. **It is absolutely forbidden during the exam session to use cell phones and/or other electronic devices with the exception of a simple hand calculator.** No other documents are allowed with the exception of a one-page study/formula sheet. The mandatory exam counts for **7.5%** of the student total grade. Each student is expected to take the exam on the scheduled date and time it is given. No make-up exams are given.

There will be a weekly assigned homework. In each homework, students are asked to submit their weekly logbook (see template on D2L) and occasionally solve a problem related to the course materials. Each group member is responsible for keeping a logbook containing a list of all the activities related to the project performed during the current week. The students are required to upload the homework to a D2L Dropbox in PDF or Microsoft Word format. The logbook and the solutions of the homework should be organized with the appropriate questions numbering, and neatly written. Homework solutions should be submitted with the posted homework questions sheet as a cover page for the whole homework submission. Homework count for **7.5%** of the total course grade. Homework are graded as follow:

Perfect logbook homework including detailed figures and calculations with the correct answers. Student showed a lot of personal effort in explaining the answers in writing and ingenuity in solving the homework	90%-100%
Logbook homework including many figures and calculations with few mistakes and/or some missing items, the homework is missing some details. Student showed some personal effort to explain and complete the homework	80%-89%
Logbook homework incomplete, missing some weekly tasks and/or answers to some problems or questions, the copy is incomplete and showing some wrong results, the copy is missing some explanation and/or detailed calculations, the homework is superficial, no real efforts are shown by the student to complete the homework	70%-79%
Logbook homework totally incomplete, poorly written, missing many weekly tasks and answers to problems and questions, most results are wrong, no efforts is showed by the student to complete the homework. The copy is lacking critical details	50%-69%
Logbook homework not uploaded to D2L	0%

Homework have to be turned-in on the due date specified on the D2L homework question sheet. Late homework will still be accepted till the end of the semester and graded with a maximum grade of 50% of the normal grade of 100%.

Weekly Progress Reports and Logbook

Each group member is responsible for keeping a logbook containing a list of all the activities performed/information received during the current week. This logbook will be used by the student to draft a personal weekly progress report. The weekly progress report must be turned-in the form of a **digital PDF copy** uploaded to a D2L Dropbox set-up by the group faculty mentor. The weekly report should contain technical documents, SolidWorks drawings, simulation results, programming algorithms done with MATLAB or other computer languages, hand calculations related to the project as well as a copy of the latest weekly logbook. The provided documents may contain mechanical components technical or specification sheets, finished or partial technical/report papers, electrical, pneumatic, and PLC circuit's schematics, etc... Additionally, any drawings done with SolidWorks or other software on a weekly basis has to be saved (Pack & Go) on a memory key with a proper short name and given to the instructor at the end of the semester. Any other documents have to be organized in folders, and saved on the memory key. The weekly progress reports will be reviewed and graded by the main faculty and the faculty mentor on a

weekly basis. Weekly progress reports and logbooks count for **15%** of the total grade, and are expressly due at the beginning of each laboratory session. If not timely submitted, they will still be accepted but graded over 50% of the regular 100% grade. **Each group member is responsible for submitting a one personal unique weekly progress report.**

Peer Evaluation

The main course instructor will conduct two peer evaluations during the semester. One in the middle of the semester and one at the end of the semester. Each group member will be asked to grade honestly his/her group peers based on his/her performance, contribution, and commitment to the group tasks and project goals during the spring semester. It is **MANDATORY** for the students to list **PROS & CONS** for each individual member of the group on the peer evaluation. The peer evaluation counts for **10%** of the total student grade. The peer evaluations should be timely uploaded to a D2L Dropbox at the request of the main instructor. Not timely uploading the peer evaluation will result will result in a peer evaluation grade of 0%.

ATTITUDE & ABSENTEEISM & PROJECT CONTRIBUTION & SHARING KNOWLEDGE WITH TEAMMATES AND FACULTY MENTOR & ATTENDING GROUP MEETINGS & ETHICAL BEHAVIOR

This item will be continuously assessed by the main senior design instructor and the group's faculty mentor for each member of the group throughout the fall semester. The final assigned grade will be based mainly on peers evaluations, class behavior, number of absences, time spent on achieving weekly and project critical goals, attendance and punctuality on all meetings, positive/negative language usage, willingness to work and share knowledge with team members, faculty mentor and machinist technician evaluation of the student's lab work, appropriate general ethical behavior, and more other evaluating criteria (listed in bullet (1)) as deemed appropriate by the main instructor and the faculty mentor. The general grade for this item counts for **20%** of the total student grade.

Public Presentations & Paper Publication & Poster

It is brought to the attention of the students that each one of them is expressly required to participate in in three of following university activities throughout the two senior design semesters: University Undergraduate Research and Creative Activity Forum (fall 2024 and spring 2025), North Texas Area Students Conference (NTASC, spring 2025). The following additional activities and contributions are also required as deemed necessary by the instructor: Counsel of Undergraduate Research conference (CUR, spring 2025), IdeaMSU (spring 2025), **writing journal/conference papers**, **preparing posters**, etc... The students are required to start preparing for these activities in the fall semester (draft poster, draft oral presentation, draft journal or conference paper, etc.). The participation in these activities counts for **10%** of the total student final grade.

Final Oral Exam

The group is required to give a collective twelve-minute oral presentation before a panel composed of the department faculty in charge of the senior design labs and guests. After the presentation and during the next eight minutes, each group member will be asked to answer a series of questions prepared by the panel regarding the project materials. The total duration of the presentation and questions is **twenty minutes**. **The oral presentation and oral exam are scheduled Wednesday November 27, 2024 at 1:00 PM in MY 136**. It is **MANDATORY** that all final oral presentations should be done in Microsoft PowerPoint and saved to a memory key provided by the department lab technician Mr. Jay Barnett. The oral presentation and the oral exam count for **15%** of the total student final grade.

Final Project Proposal Report

Toward the end of the semester, on November 20, 2024, each group will submit a final major draft proposal report with the following **mandatory requirements**: a detailed final design description, a

complete set of SolidWorks 2-D and 3-D drawings for parts and assemblies, a series of theoretical calculations and/or computer based simulations of a machine/physical process, a schematic drawing of an experimental measurement set-up procedure, a current budget with attached quotes and purchases, a Gantt chart timeline, a set of numbered references for used technical papers, books, and websites, acknowledgements for any internal/external peoples who helped/advised the group during the fall semester, and a complete set of appendices. The faculty mentor will review the draft proposal report, write his own recommendations for the final report, and turn it to the students. Students are required to adjust the report according to the faculty mentor recommendations. **The students must submit the final written proposal report with all the above-mentioned mandatory requirements no later than Friday December 6, 2024**. It is **MANDATORY** that all final reports should be written in Microsoft Word software and saved to a memory key provided by the department lab technician Mr. Jay Barnett. While a working prototype of the design is due by the end of the academic year in May 2025, each group is required this fall semester to produce and show a computer-based design (2-D drawings, and 3-D drawings) and simulation of different (stress, flow, hydraulic circuits, PLC programming, etc.) solutions of its assigned project tasks. Note: while many software tools can be used to develop a computer simulation, the most desirable ones are SolidWorks and ANSYS, since these software are available in almost every computer in the McCoy School of Engineering. Additionally, the report has to address all the requirements specified in the individualized contract sheet distributed by the faculty mentor at the beginning of the semester. The proposal report counts for **15%** of the total final student grade.

Course Grades

It is brought to the attention of the students that each one of them will be graded individually. There is strictly no collective grade for any of the items listed in the below table. Course grades are based on the following items with their assigned weighted percentage. They are summarized in the below grading table:

Graded Items	Percentage Assigned to Items
Lecture Materials Written Exam and Logbook Homework	15%
Weekly Progress Report & Logbook	15%
Peer Evaluation	10%
Attitude & Absenteeism & Project Contribution & Sharing Knowledge with Teammates and Faculty Mentor & Attending Group Meetings & Ethical Behavior	20%
Public Presentations & Paper Publication & Poster	10%
Final Proposal Presentation & Oral Exam	15%
Final Proposal Report	15%
Total maximum Grade	**100%**

The below scale will be used to assign the final course grade:

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

Student/Faculty Contract

A Student/Faculty contract will be read by the group instructor and signed by the all parties participating in the senior design laboratory. The student/faculty contract encloses the following items:

1. Contracting parties
2. Assigned faculty instructor
3. Goals and expected achievements of the project
4. Team member responsibilities
5. Meetings policy
6. Deadline policy
7. Ethical rules within the group
8. Archiving and recording the project documentation
9. Decision making
10. Resolving disputes

Machine Shop & Tools Availability

Students are not allowed in the machine shop without the presence of the machinist. The machine shop is closed to the students during the weekend and evening period. If tools are needed during the weekend or evening period, please ask our lab technician Mr. Jay Barnett to provide you with the needed ones. Students are not allowed to enter the machine shop with an open toe shoe.

Printed Copy of the Draft & Final Report

If a student needs a printed bonded copy of their senior project by May 2025, they have to write a check of $50 to the engineering department secretary, Mrs. Christina Miller.

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.

UNDERGRADUATE RESEARCH INFORMATION

Research and Creative Activity Opportunities at MSU Texas

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 UGR office located in the atrium of the Clark Student Center, room 161. Information and resources are available at www.msutexas.edu/eureca.

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!

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.

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, exams, and final project reports. 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 main course instructor.

Prepared by: *Dr. Salim Azzouz, Dr. Sheldon Wang, Dr. Jan Brink, Dr. Yu Guo, Dr. Zeki Ilhan, Dr. Mahmoud Elsharafi, and Dr. Pranaya Pokharel.*
08/05/2024.