

SYLLABUS
MENG 4243 – 201: Senior Design II
Required Course - Spring 2023

Faculty mentors: Dr. Salim Azzouz (MY 219G), Dr. Jan Brink (MY 138), Dr. Mahmoud Elsharafi (MY 219F), Dr. Yu Guo (MY 219A), Dr. Zeki Ilhan (MY 219E), Dr. Pranaya Pokharel (MY 219C), and Dr. Sheldon Wang (MY 137).

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

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

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

Lab Section, Faculty mentors, Location & Schedule:

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

A continuation of MENG 4143.

COURSE PRE-REQUISITES

Successful completion of MENG 4143.

OTHER PREREQUISITES

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

OPTIONAL TEXTBOOKS

Shigley's Mechanical Engineering Design, by *Richard G. Budynas, and J. Keith Nisbett, 11th edition*
 Engineering Design, by *George E. Dieter, 5th edition*
 Materials Science and Engineering, an Introduction, by *William D. Callister, 10th edition*

REFERENCES

Additional material will be provided in the form of handouts in D2L.

TOPICS COVERED

Topics	Topics
Materials Selection and Materials Processing	Manufacturing Processes (continuation)
Casting Processes	Mechanical Case Studies
Engineering Statistics	Leadership Qualities
Risk, Reliability, and Safety	
Robust and Quality Design	

COURSE LEARNING OBJECTIVES AND RELATIONSHIP TO PROGRAM EDUCATIONAL OUTCOMES

Outcome-Related Course Learning	1	2	3	4	5	6	7
Explain the method for materials selection	X	X		X		X	
Cite at least three techniques for materials processing	X	X					
Explain the steps pertaining to the investment casting process	X	X					
Cite at least three probability distributions	X	X					
Explain the meaning of reliability in engineering design		X	X	X	X		X
Define quality in engineering design		X	X	X	X		
Explain how to determine a shaft FOS	X	X				X	X
Explain how to dimension a Ball Bearing for a specific application	X	X				X	X
Write formal and informal engineering reports			X		X		X
Work as part of a team			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 to 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, in general, of three members from diverse backgrounds, with diverse skills and capabilities. Senior design group members were required to elect a leader and a treasurer (done in the fall semester), those positions will continue this semester. The projects are devised by the faculty or the industry and assigned to the students in the first week of the fall semester. During this spring 2023 semester, each group will continue to carry-out a set of additional project phases listed below. Those phases are needed to completely finish the senior design project by the end of the spring semester.

- **Request for Funding and Parts Ordering Phase**

Sometimes in February each group will submit a final and complete request for funding for their project, a full bill of materials, and an exhaustive list of the ordered parts as well as their final 2-D and 3-D drawings with finalized dimensions and tolerances. Each group is required to prepare and present to their faculty mentor a PowerPoint presentation about the design concept, the type of parts ordered, the suppliers, and the projected cost of the project.

- **Fabrication and Assembly Phase**

Each group has a maximum of two months, February and March, to carry out the fabrication and assembly phase of the project. By a date specified by their faculty mentor, each group through an oral presentation will present, submit, and demonstrate to the faculty mentor their fabricated machine or designed process.

- **Testing and Results Processing Phase**

Toward the end of the semester, each group will submit to their faculty mentor a working prototype or process of their final design. A partial oral presentation showing a testing procedure with pictured experiment set-ups is also required. Testing results have to be shown and discussed.

1. The faculty mentor in charge of the project is there to guide the students, advise them, supervise 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 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 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 students that the deliverable might change, depending on the project advancement, and/or 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, and/or the department machinist technician, and/or the department lab technician, and/or external company engineers or technicians must be reported immediately to the faculty mentor in charge of the project 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 of a machine part has to have the approved signature of the faculty mentor in charge of the group, the machinist technician, or external company engineer or technician before the component is ordered or manufactured.
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. The purchase has to stay within the allowed project budget which is \$2,000/group.

LECTURE, EXAMS, HOMEWORK, LOGBOOK

This course consists of a one-mandatory hour lecture and four mandatory-hour laboratory design sessions per week. The one-hour lecture session includes mostly a talk by the instructor, and sometime a general discussion of the projects 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). 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 formula sheet. The mandatory exam counts for **7.5%** 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 have to be turned-in on the

due date specified on the 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 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 mentor. The weekly report should contain technical documents, drawings, simulation results, 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 schematic, 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 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 personal one weekly progress report.**

PEER EVALUATION

The 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 project 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 spring 2023 semester. The final assigned grade will be based on class behavior, number of absences, time spent on achieving weekly and project critical tasks, attendance and punctuality on all meetings, positive/negative language usage, willingness to work and share knowledge with team members, faculty mentor, and machinist technician, 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 2022 and spring 2023), North Texas Area Students Conference (NTASC, spring 2023). The following additional activities and contributions are also required as deemed necessary by the instructor: Counsel of Undergraduate Research conference (CUR, spring 2023), IdeaMSU (spring 2023), writing conference/journal papers, etc... The students are required to start preparing for these activities in the fall semester (draft poster, draft oral presentation, draft paper, etc...). The participation in these activities counts for **10%** of the total student final grade.

FINAL SENIOR DESIGN II PRESENTATION & ORAL EXAM

The group is required to give a collective fifteen-minute oral presentation before a panel composed of the department faculty in charge of the senior design labs. After the presentation, each group member will be asked to answer a series of questions prepared by the panel regarding the project materials. **The oral presentation and oral exam are scheduled Wednesday April 26, 2023 at 1:00 PM in MY 136.** It is **MANDATORY** that all final oral presentations should be done in **Microsoft PowerPoint** and uploaded to a D2L Dropbox folder set by the main instructor. The oral presentation and the oral exam count for **15%** of the total student final grade.

SENIOR DESIGN II FINAL REPORT

Toward the end of the semester, on **April 19th, 2023**, each group will submit a final major draft report containing an introduction, a description of the final design with a complete set of 2-D and 3-D drawings for parts and assemblies, a theory for the machine concept or process, a testing procedures, a set of exhaustive results and/or simulations of different solutions, a request for funding, a bill of materials, a final detailed cost of the project with quotes, a detailed Gantt chart, references, appendices, and acknowledgments. The group has also to submit a draft for the final PowerPoint (PPT) presentation on the same day. The faculty mentor will review the draft report and the PPT presentation, writes his own recommendations for the final report, and turn it to the students to finalize it. **The students are required to submit the final report by April 26th, 2023.** It is **MANDATORY** that all final reports should be done in **Microsoft Word Format** and uploaded to a D2L Dropbox folder set by the main instructor. It is also **MANDATORY** that all groups show a **WORKING PROTOTYPE** of the design or **PROCESS** at the end of the semester May 2023. Each group is required this spring 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, etc.) solutions pertaining to their assigned project. 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. Also the report has to address all the requirements specified in the individualized contract distributed by the group instructor at the beginning of the fall semester. The final report counts for **15%** of the total final student grade.

If the material submitted by the students at the end of the semester, including the final product, is partial, imperfect, and unfinished, the students will receive an incomplete grade of (I), and will be required to complete the project in the following weeks.

COURSE GRADES

Course grades are based on the following items and summarized in the grading form, with the relative % weighting shown below:

Graded Items	Percentage Assigned to Items
Final Exam and Homework	15%
Weekly Progress Report & Log books	15%
Peer Evaluation	10%
Attitude & Absenteeism & Project Contribution & Sharing Knowledge With Teammates and Faculty Mentor & Attending Group Meetings & Ethical Behavior	20%

Graded Items	Percentage Assigned to Items
Public Presentations & Paper Publication & Poster	10%
Final SD II Presentation & Oral Exam	15%
Final SD II Project Report	15%
Total maximum Grade	100%

The below scale is used to assign the final course grade X:

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 (Done in the Fall 2022 semester)

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 time periods. If tools are needed during the weekend or evening periods, please ask our machinist-technician (Mr. Frank Bohuslav) or lab-technician (Mr. Jay Barnett) to provide you with the needed tools.

PRINTED COPY OF THE DRAFT & FINAL REPORT

The draft copies of the final report should be printed on both sides of the printing paper. If a student needs a printed bonded copy of their senior project, they have to write a check of **\$50** to our secretary (Mrs. Christina Miller).

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 each student's WebWorld account. At-risk students

will be reported and will receive a midterm overall grade. 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.

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. 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, she 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 2023 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.

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.

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

1/111/2023