

SYLLABUS
MENG 4143 – 101: Senior Design I
Required Course - Fall 2022

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

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

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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, Instructors, 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 139 | 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, *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, 9th edition*

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 students the opportunity to work in an environment which closely simulates a real workplace environment. The students will work in groups composed of three members from diverse backgrounds, with diverse skills and capabilities. Each senior design group of students is required to elect a leader and a treasurer. The projects are devised by the faculty or the industry and assigned to the students in the first week of the fall semester. Each group will carry-out a set of project phases from a brainstorming phase, a product fabrication phase, and a testing phase.

Brainstorming Phase

Within the first few weeks after the starting of the 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 parts and assemblies are required for this step. By a date specified by the instructor toward the beginning of November, 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, quotes, 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. A general template of the report will be sent to the students as guidance report.

Guidelines for the Students

1. The instructor in charge of the student group is there to guide the students, advise them and supervise them. The instructor is not there to do the students' work. The instructor expects the students to behave professionally and ethically throughout the duration of the project. Any student caught misbehaving in class, using foul language, making derogatory remarks in writing through emails or verbally in class may be dismissed from it. A complete dismissal from class for the remainder of the semester may occur if the offenses made by the student are considered very serious by the instructor. Not attending or arriving late to scheduled lectures, labs, and meetings may cost the student the full attitude & absenteeism & participation & sharing knowledge with teammates and instructor & ethics grade, which is **20%** of the total grade.
2. It is brought to the attention of the student 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, 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 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. The purchase has to stay within the allowed budget which is \$2,000/group.

Lecture, Homework, Exams, and Laboratory

This course consists of a one-mandatory lecture hour and four mandatory laboratory hours per week. The one-hour lecture session includes an instructor talk about the topics listed above and sometimes a short discussion about the projects progression (weekly lab assignments, difficulties, needs, and issues encountered). The lab time will be spent by the groups working on their projects on their own and under the supervision of their instructor and when needed the machinist technician. 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 instructor. 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 to complete all required tasks. In this first semester the students are required to submit their final proposal report, and their final proposal presentation with all the required deliverables specified in the project personal requirement sheet. **If the material submitted by the students at the end of the semester 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.**

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 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 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%. A final exam will be administered at the end of the fall semester. The exam will be in-person, face-to-face, and based on the materials studied during the class lecture. The homework and the mandatory written exam count for **15%** of the total course grade. The solutions of the exam should be written on the handed answering sheets. You are expected to take the exam on the scheduled date and given time. There will be no make-up final exam given anytime toward the end of the semester.

Weekly Progress Reports and Logbook

The weekly progress report must be turned-in the form of a document stack containing a front list of the current weekly activities. The weekly report should contain technical documents, drawings, calculations related to the project as well as a copy of the latest weekly page of the logbook. The provided documents may contain mechanical components technical or specification sheets, finished or partial technical papers,

electrical, pneumatic, and PLC schematic, etc.... Additionally, any drawings done with SolidWorks or other software on a weekly basis has to be saved 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 also saved on the memory key. The weekly progress reports will be reviewed and returned to the students by the instructor on a weekly basis. Weekly progress reports count for **15%** of the total grade. The students are required to upload the weekly progress report to a D2L Dropbox in PDF or Microsoft Word format. The weekly reports should have the posted required cover page. They should be neatly written, well organized with appropriate paragraph and document numbering. Weekly report should be uploaded to a D2L Dropbox weekly before the beginning of the lab session. The maximum grade for the timely submitted weekly report on the due date is 100%. Late weekly reports will still be accepted till the end of the semester and graded with a maximum grade of 50%. Each group member is responsible for submitting his/her weekly progress report.

Peer Evaluation

The instructor will conduct two peer evaluations during the semester. One in the middle of the semester and one toward the end of the semester. Each group member will be asked to grade honestly his/her group peers based on his/her performance and commitment to the project during the fall semester. The peer evaluation counts for **10%** of the total student grade. The peer evaluations should be uploaded to a D2L Dropbox at the request of the main instructor.

Attitude, Absenteeism, Participation, Sharing Knowledge, and Ethics

The attitude, absenteeism, participation, sharing knowledge with teammates and instructor, and ethical behavior of each member of the group is going to be assessed throughout the semester by the instructor. The assigned grade will be based on absenteeism, tasks achieved on time, punctuality, language, willingness to work and share knowledge with team members, instructor, and machinist technician, appropriate ethical behavior, and more as deemed appropriate by the instructor. The general attitude, absenteeism, participation, sharing knowledge with teammates and instructor, and ethical behavior of the student count for **20%** of the total 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 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 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 November 30, 2022.** 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.

Final Project Proposal Report

Toward the end of the semester, on November 23, 2022, each group will submit a final major draft proposal report containing a detailed final design description, SolidWorks 2-D and 3-D drawings for parts

and assemblies, a series of calculations and/or simulations, a budget with quotes, a Gantt chart timeline, references, and appendices. The instructor will review the draft proposal report, write his own recommendations for the final report, and turn it to the students. **The students are required to submit the final written proposal report by November 30, 2022.** All final reports should be done in Microsoft Word and uploaded to a D2L Dropbox folder set by the main instructor. While a working prototype of the design is due by the end of the academic year (May 2023), 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, etc.) solutions of its 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 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 are 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 Homework | 15% |
| Weekly Progress Report & Logbooks | 15% |
| Peer Evaluation | 10% |
| Attitude & Absenteeism & Participation & Tasks Achieved on Time & Sharing Knowledge with Teammates and Instructor & Ethics | 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.

Printed Copy of the Draft & Final Report

If a student needs a printed binded copy of their senior project by May 2023, 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. 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.

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.

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.

08/19/2022