MTSE 4100: Senior Capstone Project
Spring 2026 Syllabus

Class Schedule & Credits

Course Dates	01/12/2025 – 05/09/2025
In-Class Sessions	Tu/Th 1:00 pm to 2:20 pm
Classroom	DP B157
Credits	3 credits

Instructor

Name	Dr. Dwight Burford (Faculty Page)
Office	DP E215g
Office Hours	By appointment via email (face-to-face or via Zoom/Teams)
Email	dwight.burford@unt.edu
	Note: Depending on the scope and complexity of the communication, most emails are expected to be answered within 24 to 48 hours.

Contact Hours

Semester class times will be for each team to work on team project tasks. It will also include reviews and instruction as listed in the **Course Schedule** and as announced during the semester.

- First Day of Class: On January 13, course expectations and instruction will be provided. This is a required lecture for all students enrolled in the class.
- Project cadence: Starting January 28, each team will have bi-weekly progress meetings with the instructor during scheduled class times (to be arranged).

Textbook

- **This is a self-guided semester based on MTSE 4090!**
- No specific text is required for this course.
- Any supplemental materials will be provided throughout the semester via Canvas.

Submissions

- **All presentation files, report files, and poster files** are to be submitted by placing them in an appropriately labeled **MS Teams folder(s)**.
  - **Input by each (individual) team member must be noted in each file.**
  - **Gantt charts are mandatory in each file.**

Course Information

a. Brief description of the content of the course (catalog description).

- The primary objective of this course is to provide every student with a team environment to experience "real world" engineering design which draws on many of the skills that they have been mastered during their studies in the Department of Materials Science and Engineering at the University of North Texas.

- **Students shall exhibit an ability to design a system, component, or process to meet a desired need**. This is a two-course sequence with the second course (this course, MTSE 4100), providing time for completion of a design project set up during the first course (MTSE 4090) by:
    - Evaluating the project plan from last semester
    - Performing work towards completion of the team project
    - Presenting progress of work, both orally and in writing

b. Prerequisites or co-requisites

- MTSE 3010, MTSE 3020, MTSE 3030, MTSE 3040, MTSE 3050, MTSE 3070, MTSE 3080, and MTSE 4090

c. Indicate whether a course is required, elective, or selected elective in the program:

- Each is required.

Specific Goals for the Course

a. Specific outcomes of instruction

- Students are expected to function in a team environment that is similar to that which they will encounter in their careers outside the university setting. As such, **instructors have two main functions: to serve as advisors to the senior design student/teams and as evaluators of student/team progress consistent with course requirements**.
- Students are *expected to operate effectively in a team environment* in which members work together to provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- Students will identify and describe a design problem with the help of the faculty mentor (instructor) and must demonstrate an ability to apply and integrate knowledge of material structure, properties, processing and performance for a materials selection and design problem. Students must consider additional aspects such as the economic, environmental, ethical, safety, as well as social and political impacts of the effort.
- Students will demonstrate an ability to present technical information clearly in both oral and written formats.
- Students must demonstrate ethical principles and professional responsibilities in an engineering context which must consider additional aspects such as the economic, environmental, ethical, and safety, as well as social and political impacts of the effort.
- Students must demonstrate an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- Students must demonstrate an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

- This course addresses ABET Student Outcome(s): 1, 2, 3, 4, 5, 6 & 7

Team Specific Responsibilities

- Teams are responsible for:
  - Planning and coordinating all meetings that are required for completing the project.
  - Scheduling time with the faculty advisor and industrial sponsor (as applicable).
  - Reviewing the educational objectives carefully to determine additional details that should be considered in all senior design presentations and written reports.
- Student Design Teams are responsible for a series of written reports that build on the previous one in completing the final reports that will be submitted at the end of the semester.
  - A separate document will be provided by the course instructor with a description of the information to be included in reports.
  - **NOTE: All Data Must Reflect Statistical Analysis (e.g. error bars, confidence ranges etc.)**
- Every written report must include a cover page with:
  - Course number
  - Title of the project
  - Date
  - Team (group) number
  - Names of the design team members
  - Faculty advisor(s)
  - Industrial sponsor/contact person (as applicable)
- Every written report must also include:
  - Citations/References
  - Appendices (e.g. MSPD information)
- The Student Design Teams will be responsible for **a 3ft x 4ft poster** at the end of the semester for the Senior Day Presentation (Week 14) that:
  - Summarizes the final written report, and
  - Includes the same project aspects that are described above.
  - Note: Contact Lisa Dunlop (MSTE Office) for information about printing posters, etc.
- Notes: Review the educational objectives carefully to determine additional details that should be considered in all senior design presentations and written reports per the ABET Outcome 3 requirements. These include:

  1. an ability to identify, formulate, and solve complex engineering problems by applying 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 judgments, 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 judgment to draw conclusions; and
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- Further Notes:

1. Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and **incorporating appropriate engineering standards and multiple realistic constraints.**
2. The curriculum must prepare graduates to apply advanced science (such as chemistry and physics) and engineering principles to materials systems implied by the program modifier, e.g., ceramics, metals, polymers, composite materials; **to integrate the understanding of the scientific and engineering principles underlying the four major elements of the field: structure, properties, processing, and performance** related to material systems appropriate to the field; **to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems, and to utilize experimental, statistical, and computational methods** consistent with the program educational objectives.
3. Student behavior that interferes with an instructor's ability to conduct a class or other students' opportunity to learn is unacceptable and disruptive and will not be tolerated in any instructional forum at UNT. Students engaging in unacceptable behavior will be directed to leave the classroom, and the instructor may refer the student to the Dean of Students to consider whether the student's conduct violated the Code of Student Conduct. The University's expectations for student conduct apply to all instructional forums, including University and electronic classroom, labs, discussion groups, field trips, etc. Visit UNT's Code of Student Conduct (https://deanofstudents.unt.edu/conduct) to learn more.

Course Schedule (Tentative)

Week 1: Expectations and instruction
Week 2: Groups present progress report to the respective team advisor(s)
Week 3: **Review of progress. Revisions, design success criterion, updated GANTT charts, picture/diagram/flowchart/visual representation of design concept due (submitted by MS Teams—send email to the course instructor when files are ready to be graded).**
Week 4: Groups present progress report to the respective team advisor(s)
Week 5: Groups present progress report to the respective team advisor(s)
Week 6: **Preliminary project progress DUE** – 10 min presentation to advisory groups; questions and answers
Week 7: Groups present progress report to the respective team advisor(s)

Week 8: Groups present progress report to the respective team advisor(s)

Spring Break: March 9-15, 2025

Week 9: Groups present progress report to the respective team advisor(s)

Week 10: **Project progress presentation report DUE** – Report and 10 min presentation to advisory groups; questions and answers

Week 11: Groups present progress report to the respective team advisor(s)

Week 12: Groups present progress report to the respective team advisor(s)

Week 13: Groups present progress report to the respective team advisor(s)

Week 14: **Senior Design Day: Oral and Poster Presentations**

Week 15: **Final Written Report & Team Evaluations DUE**

Grading

- Students will be evaluated based on **individual and team participation** through submitted progress reports, team evaluations, prepared presentations, posters, and written reports. Key elements include:
  - Timely submission of reports, presentations
  - Progress on execution of project
  - Presentation, poster, and defense
  - Final Written Report
- Grades will be assigned using the following scale:

A: 90-100 | B: 80-89.99 | C: 70–79.99 | D: 60–69.99 | F: 0–59.99

Artificial Intelligence (AI) General Policy

- AI may be used in developing and preparing the formulation of team projects during the course under certain conditions outlined in this section.
- **Proper attribution of AI must be clearly included in reports and presentations**.
- That is, information and data acquired through open AI chatbots (programs), such as ChatGPT, Grok, Gemini, etc., must be cited and/or referenced clearly in all presentations and reports.
- In reports, the following requirements must be met:
  - First, include the question and/or information input to prompt the AI chatbot.
  - Second, clearly quote the relevant output from the chatbot or similar program.
- While AI is used in most word processing programs, e.g. MS Word, you may not use AI chatbots to generate your reports.
  - All material from a chatbot must be clearly identified as referenced material, not represented as your own work.
  - Any report content that is AI generated that is not properly attributed (referenced) will be treated as plagiarism.

Miscellaneous Information

Complex Engineering Problems: Complex engineering problems include one or more of the following characteristics:

- wide-ranging or conflicting technical issues having no obvious solution(s)
- problems not encompassed by current standards or codes

- diverse groups of stakeholders
- many component parts or sub-elements
- multiple disciplines
- significant consequences in a range of contexts

Engineering Design: Engineering design is a process of devising a system, component, or process to meet desired needs and specifications within constraints. It is an iterative, creative, decision-making process in which the basic sciences, mathematics, and engineering sciences are applied to convert resources into solutions. Engineering design involves identifying opportunities, developing requirements, performing analysis and synthesis, generating multiple solutions, evaluating solutions against requirements, considering risks, and making tradeoffs, for the purpose of obtaining a high-quality solution under the given circumstances.

Engineering Science: Engineering sciences are based on mathematics and basic sciences but carry knowledge further toward creative application needed to solve engineering problems. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other.