UNIVERSTY OF NORTH TEXAS – Department of Mechanical Engineering

MEEN 4250 Capstone Design II

SYLLABUS **Fall 2025** **3 Credit hours**

Instructor:	Dr. Hassan Qandil (hassan.qandil@unt.edu)
Office Hours:	By email appointment or Office walk-ins
Lecture:	MoWe 10:00AM - 11:20AM - NTDP E266
CAE Labs:	Sa 10:00AM - 4:00PM- Pettinger Center for Design and Innovation (Optional)
Fabrication Labs:	**Check with the EMF and the Pettinger Center for Design and Innovation staff**
TAs:	TBD
TA Office Hours:	TBD

This course is connected to Study Abroad Program in Istanbul-Turkey (Dec-30 – Jan-10)

For more info and applications: Visit this link

Prerequisite(s): Passing the following with a "C" or better:

1) MEEN 4150 Senior Design 1
2) MEEN 3100 Manufacturing Processes

CO-REQUISITEs:

1) MEEN 4250.3XX: Senior Design Laboratory

Catalog Course Description:

The Capstone Core course in Mechanical and Energy Engineering is the culminating experience for the Bachelor of Science degree. It builds on MEEN 4150 (MEE Design I), where student teams work on product design, development, and manufacturing projects aimed at benefiting society. The course simulates a professional workplace, encouraging students to integrate knowledge from various areas, make ethical decisions, manage resources, and adhere to project schedules. A key learning outcome is that students will recognize how exposure to diverse perspectives enriches their thinking.

REQUIRED TEXTBOOK:

"***Engineering Design***", George Dieter, Linda Schmidt. McGraw Hill (ISBN: 1260113299), 2021.

IMPORTANT RESOURCES AND TEXTBOOKS:

1) "***Design Workbook Using SOLIDWORKS 2024***", Ronald E. Barr et al., SDC Publications, (ISBN: 978-1-63057-638-7), 2024.
2) ***"A Hands-On Introduction to SOLIDWORKS 2024"***, Kirstie Plantenberg, SDC Publications, (ISBN: 978-1-63057-633-2), 2024.
3) "***Engineering Analysis with SOLIDWORKS Simulation 2024***", Paul Kurowski, SDC Publications, (ISBN: 978-1-63057-629-5), 2024.
4) "***Control Systems Engineering***", Norman S. Nise, WILEY, (ISBN: 978-1119721406), 2020.
5) ***"Finite Element Simulations with ANSYS Workbench 2023"***, Huei-Huang Lee, SDC Publications, (ISBN: 978-1-63057-615-8), 2023.

COURSE OUTCOMES:

1. Gain experience working in teams.
2. Apply program management skills such as budgeting, scheduling, parts selection.
3. Apply engineering knowledge to design / construct solutions to real-world problem.
4. Enhance technical communications skills via written reports and presentations.

5. Apply engineering design skills from CAE - Computer Aided Engineering, to DFM/DFA - Design for Manufacturing & Assembly, and GDT - (Geometric Dimension and Tolerance) blueprint making.

ABET Major Design Experience:

This course satisfies an ABET accreditation requirement for a major design experience. "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 science, math, and engineering sciences applied converting resources to solutions.
Engineering design involves identifying opportunities, developing requirements, performing analysis and synthesis, generating multiple solutions, evaluating solutions against requirements, considering risks, and making trade-offs, for purpose of obtaining a high-quality solution under given circumstances. For illustrative purposes only, examples of possible constraints include accessibility, aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, standards, sustainability, or usability"

ABET Program Educational Objectives (PEO's):

PEO's developed by department stakeholders and supported by senior design capstone course are:

1. Graduates successfully employed in mechanical and/or energy engineering positions and other related fields.
2. Graduates engage in lifelong learning demonstrated by advanced education, professional development activities and/or other career-appropriate options.
3. Graduates are prepared to successfully demonstrate technical and leadership competence through ethical conduct, teaming, communication and/or problem-solving skills learned in our program

ABET STUDENT OUTCOMES

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
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

GRADES:

Standard grading scale used: 90/80/70/60. All members receive same score for team assignments unless evidence of non-participation exists. Individual scores for individual assignments. Extended deadlines are NOT allowed only exception being University excused absences with documentation provided.

FMEA + Public Welfare	5
Optimization & Design Study + GD&T	5
DFM & Material Selection	10
DFA	5
DFC	5
CAE Design Analysis	10
Midterm Presentation	5
Prototype Fabrication & Testing (Functionality)	15
Blueprints (Individual + Assembly)	10
Final Presentation + Marketing Package	10
Final Report	15
Class Attendance + Peer Review	5
SPOT Evaluation	1 (Extra)
Shop Safety (Mandatory Training at EMF Lab)	Pass/Fail
Engineering Ethics	Pass/Fail

TENTATIVE CLASS SCHEDULE

(Due: Green=Team Submission, *Purple=Individual Submission*)

Mile-stone	Week	Dates	Mondays	Wednesdays	Lab Due*	Project Due*	Other Due*
Finalize Simulation	1	Aug. 18th – Aug. 22nd	Risk, Reliability, and Safety	Materials Selection			*Team Schedule*
	2	Aug. 25th – Aug. 29th	**Team Leader Meeting**	Design for Manufacturing		FMEA	*Peer-1*
	3	Sept. 1st – Sept. 5th	**Labor Day – No Class**	Design for Assembly		Material	
	4	Sept. 8th–Sept. 12th	**Critical Design Review (CDR) – Discussion-1**	Cost Evaluation		DFM	
Order & Wait on Parts	5	Sept. 15th – Sept. 19th	Legality/Ethics in Design	Human Factors in Design	CAE	DFA	Approv-1
	6	Sept. 22nd – Sep. 26th	**Critical Design Review (CDR) – Discussion-2**	GDT	*Optimiz.*	DFC	
	7	Sep. 29th – Oct. 3rd	**Team Leader Meeting**	Testing Methods	*BP-Part.*		
Fabrication and Testing	8	Oct. 6th – Oct. 10th	No Lecture (Fabricate & Test)	Non-conventional manufact.	BP-Asm.		
	9	Oct. 13th – Oct. 17th	**(Oct-15-2025 Midterm Presentations)**		*GDT*	Welfare	
	10	Oct. 20th- Oct 24th	No Lecture (Fabricate & Test)	**Team Leader Meeting**		Ethics	Approv-2
	11	Oct. 27th- Oct. 31st	No Lecture (Fabricate & Test)	**Team Leader Meeting**		Testing	
	12	Nov. 3rd- Nov. 7th	No Lecture (Fabricate & Test)	**Team Leader Meeting**			Market. package
	13	Nov. 10th- Nov. 14th	No Lecture (Fabricate & Test)	**Team Leader Meeting**			Approv-3
	14	Nov. 17th- Nov. 21st	**Design Day Nov-21-2025 (Final Presentations)**				
	15	Nov. 24th - Nov. 28th	**Thanksgiving Break - No classes**			Final Report	

The due date is the final deadline for submitting an assignment/document. However, teams are encouraged to submit earlier when ready to allow more time for ordering parts and fabrication.

TEAMWORK

1. *Teamwork is major objective of* senior design. Each team member expected to contribute to the project equally. At various points, team members will evaluate each other's participation. Evaluations play a role in final course grades. If at any time a team feels a certain member is not supporting team appropriately, instructor notified immediately. The following activities would be considered detrimental to teamwork aspect of this course:
    a) Lack of participation in team activities.
    b) Lack of contribution to the design process.
    c) Not meeting deadlines.
    d) Unethical behavior such as plagiarism or fabricating test results.
    e) Poor working relationships with team members, advisors, staff members.
    f) Misuse of project materials.
    g) Actions which jeopardize team progress.
2. Missing meetings and not assisting your teammates because of work, etc. is not excusable per UNT policy. Students should expect to spend a significant amount of time working on this project at UNT Discovery Park. Students must adjust schedules accordingly. Team must find times to meet that are acceptable to everyone.
3. *The instructor reserve right to reduce a student grade based on lack of teamwork. This includes dropping student, even if all individual grades otherwise passing.*

DESIGN PROJECT REQUIREMENTS

1. Design projects must be related to mechanical engineering. Project should be the design of a device, machine or system that implements mechanics, thermal, fluids, energy, and control systems modeling. Project must have broad enough scope that it demonstrates a student's knowledge of mechanical fundamentals. Projects may include non-mechanical portions such as electronics and instrumentation, but they may not be primary discipline. Project solutions must involve three or more of the following mechanical engineering disciplines:
    a. Solid Mechanics
    b. Fluid Mechanics
    c. Thermal Sciences
    d. Decision Sciences - Systems modeling and feedback controls
    e. Energy Systems, HVAC
    f. Machine design / robotics
    g. Manufacturing Processes
2. Projects and solutions must be open-ended that require an engineer to solve a problem. A problem with one obvious solution is not acceptable. Having many workable solutions allows teams to determine the "best" solution and provide reasoning behind their selection. Multiple alternatives are presented and evaluated, with a decision process which assesses how to determine final design configuration.
3. Projects and solutions are required to have specific constraints which are measurable, i.e., weight, size, cost, performance, efficiency, etc. Measurable goals and constraints are developed and documented in a system specification.

4. Projects and solutions must require background research to be done. If the solution has already been published, project is not acceptable.
5. Projects and solutions require proof that design is feasible to manufacture, functional, and safe. Analysis helps reduce risk of failure before fabrication but is not proof. Fabrication and tests are required.
6. Projects and solutions must be able to be completed within 2 semesters.
7. Projects must be complex enough to require at least 3 students per team, but not more than 6.
8. Projects and solutions should be complex enough to allow each team member to have responsibility for a major design element – typically one assembly of parts. If a team can implement a solution, buy materials and build it without any engineering analysis to reduce risk or assess capability versus safety or performance requirements, it is not acceptable. Simple solutions require additional scope to provide all students equal opportunity to accomplish requirements. Each student must have opportunity to lead design of major element or assembly (collection of parts) that require:
    i. Preliminary Design: research and concept development.
    ii. Detailed Design: computer engineering analysis using solid modeling FEA.
    iii. Fabrication: construct using generally accepted engineering fabrication methods and materials.
    iv. Test: Instrument, test, and evaluate design and compare to analysis.
    v. Drawings - create detailed part and assembly drawing of component.

COURSE POLICY:
Course delivery method is in-person. All course announcements, lecture notes, recorded material and assignments will be posted on the MEEN 4250 Canvas courses. ***Students are expected to have access to textbooks/Software on their own, either on- or off-campus***.

ASSIGNMENTS:
All **assignment submissions are online** **through CANVAS and in a PDF format**. **NO LATE SUBMISSIONS ALLOWED** except for students with UNT-approved excuse.

FABRICATION & TESTING:
All **fabrication and testing will be on-campus unless requested otherwise by the sponsor**. If needed due to COVID-19 emergency regulations, fabrication may transition to 3D-printing format.

ATTENDANCE:
Students are expected to attend class meetings regularly and to abide by the attendance policy established for the course. It is important that you communicate with the professor and the instructional team prior to being absent, so you, the professor, and the instructional team can discuss and mitigate the impact of the absence on your attainment of course learning goals. Please inform the professor and instructional team if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community.

[IF NEEDED] COURSE MATERIALS FOR REMOTE INSTRUCTION:
Remote instruction may be necessary if community health conditions change or you need to self-isolate or quarantine due to COVID-19. Students will need access to a webcam and microphone to participate in fully remote portions of the class. Information on how to be successful in a remote learning environment can be found at https://online.unt.edu/learn

ACADEMIC INTEGRITY STANDARDS AND SANCTIONS FOR VIOLATIONS:
According to UNT Policy 06.003, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University. Academic dishonesty will not be tolerated and will result in zero assignment score and reported to Office of Academic Integrity. No exceptions. Having any calculator not on the approved list is a violation of Academic Integrity.

ADA Policy:
UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one's specific course needs. Students may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the ODA website (https://disability.unt.edu/).

STUDENT PERCEPTIONS OF TEACHING EFFECTIVENESS (SPOT)
Course participates in SPOT evaluations (http://spot.unt.edu/ or email spot@unt.edu).

RETENTION OF STUDENT RECORDS:
Course follows Family Educational Rights and Privacy Act (FERPA) laws and UNT Policy 10.10, Records Management and Retention.

SYLLABUS CHANGES:
Instructor reserves right change syllabus. Any changes announced in class and posted to CANVAS with an accompanying email to student's UNT email address.

ACCEPTABLE BEHAVIOR:
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. To learn more, visit UNT's Code of Student Conduct (https://deanofstudents.unt.edu/conduct).

ACCESS TO INFORMATION - EAGLE CONNECT:
Students' access point for business and academic services at UNT is located at: my.unt.edu. All official communication from the University will be delivered to a student's Eagle Connect account. For more information, please visit the website that explains Eagle Connect and how to forward e-mail Eagle Connect (https://it.unt.edu/eagleconnect).