

UNIVERSITY OF NORTH TEXAS – Department of Mechanical Engineering
MEEN 4250-001 **Capstone Design II**
SYLLABUS Spring 2022 3 Credit hours

Instructor:	Dr. Hassan Qandil (hassan.qandil@unt.edu)
Office Hours:	By appointment via Zoom.
Lecture:	MoWe 12:30PM - 01:50PM - NTDP F175
Software Labs:	Sa 08:00AM - 08:00PM - NTDP F119
Fabrication Labs:	Times TBD - NTDP D170 + NTDP F160
Tas:	TBD
TA Office Hours:	By appointment via Zoom.

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

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

Catalog Course Description: Capstone Core course in Mechanical and Energy Engineering is culminating experience of Bachelor of Science degree in MEE and is a direct continuation of MEEN 4150, MEE Design I. Student teams complete product design, development, and manufacturing projects conceived to promote common good of society. Course patterned on a professional work-place environment that allows students to make connections between different areas of knowledge. Students learn decision-making strategies that include ethical analysis by planning and managing resources while adhering to overall project schedule. As major learning outcome of this capstone course, students will be able to express ways that exposure to different areas, perspectives, and viewpoints enriches their thinking.

Optional Resources and Textbooks:

- 1) *“Engineering Design with SOLIDWORKS 2021”*, David C. Planchard, SDC Publications, (ISBN: 978-1630574000), 2021.
- 2) *“Engineering Analysis with SOLIDWORKS Simulation 2021”*, David C. Planchard, SDC Publications, (ISBN: 978-1630574000), 2021.
- 3) *“Control Systems Engineering”*, Norman S. Nise, WILEY, (ISBN: 978-1119721406), 2020.
- 4) *“Processes and Design for Manufacturing”*, 3rd Ed., Sherif D. El Wakil, CRC Press, (ISBN: 978-0429014918), 2019.

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 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 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.

Project Plan + Risk Management + Public Welfare	5
Optimization & Design Study + GD&T	5
DFM	10
DFA	5
DFC	5
CAE Design Analysis	10
Midterm Presentation	5
Prototype Fabrication/Software Design	10
Prototype Test (Hardware/Software + Assignment)	10
Blueprints (Individual + Assembly)	10
Final Presentation + Poster + Video	10
Final Report	10
Class Attendance + Peer Review	5
Customer, Team, Instructor Evaluation	3 (Extra)
Safety (Mandatory Training)	Pass/Fail
Engineering Ethics	Pass/Fail

TENTATIVE CLASS SCHEDULE (Submissions: Green=Team, Pink=Individual)

	Week	Dates	Lecture	Lab	Lab Due	Project Due	Other Due	
Finalize Simulation	1	Jan. 18 th - Jan. 21 st	Intro + Project Plan	No Lab				
	2	Jan. 24 th - Jan. 28 th	Risk Mgmt + Public Welfare	Optimization & Design Study				
	3	Jan. 31 st - Feb. 4 th	DFM	Blueprints	Optimize	Risk	Peer-1	
Order Parts	4	Feb. 7 th - Feb. 11 th	DFA, DFC	Blueprints		Welfare		
	5	Feb. 14 th - Feb. 18 th	Human Factors in Design	GDT		DFM	Approv-1	
Wait on Parts	6	Feb. 21 st - Feb. 25 th	Non-conventional manufacturing	GDT	BP-Parts	DFA		
	7	Feb. 28 th - Mar. 4 th	Engineering Ethics	Recitation & Office Hours	BP-Asm.	DFC		
Fabrication and Testing	8	Mar. 7 th - Mar. 11 th	Testing Methods	Recitation & Office Hours	GDT	CAE		
	9	Mar. 14 th - Mar. 18 th	SPRING BREAK					
	10	Mar. 21 st - Mar. 25 th	(Midterm Presentations)				Ethics	Approv-2
	11	Mar. 28 th - Apr. 1 st	No Lecture (Fabricate & Test)	Recitation & Office Hours		Testing		
	12	Apr. 4 th - Apr. 8 th	No Lecture (Fabricate & Test)	Recitation & Office Hours				
	13	Apr. 11 th - Apr. 15 th	No Lecture (Fabricate & Test)	Recitation & Office Hours				
	14	Apr. 18 th - Apr. 22 nd	No Lecture (Fabricate & Test)	Recitation & Office Hours			Approv-3	
	15	Apr. 25 th - Apr. 29 th	Design Day Apr-29-2022 (Final Presentations)				Final Report	Peer-2

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.

FACE COVERINGS:

UNT encourages everyone to wear a face covering when indoors, regardless of vaccination status, to protect yourself and others from COVID infection, as recommended by current CDC guidelines. Face covering guidelines could change based on community health conditions.

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 you experience any symptoms of COVID-19 (<https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>) please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact the UNT COVID Team at COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure.

[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>).