MEEN 4250 Capstone Design in Mechanical and Energy Engineering
SPRING 2019  3 Credit hours

Co-Instructors: Dr. Mark Wasikowski and Dr. Radek Glaser
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Teaching Assistants: TBD

Lectures: Both sections will maintain same teaching schedule and curriculum.
Section 1 (Glaser):           MW 12:30–1:50 AM, NTDP F175
Section 2 (Wasikowski): TR 2:00–3:20 AM, NTDP F175

Prerequisite(s): complete following with grade of C or better
1) MEEN 4150 Senior Design 1
2) MEEN 3100 Manufacturing Processes

Co-requisite(s):
1) MEEN 4250.3XX: Senior Design Laboratory

Catalog Course Description: This Capstone Core course in Mechanical and Energy Engineering (MEE) is the culminating experience of the Bachelor of Science degree in MEE, and it is a direct continuation of MEEN 4150, MEE Design I. Student teams complete product design, development, and manufacturing projects conceived to promote the common good of society. The course is patterned on a professional work-place environment that allows students to make connections between different areas of knowledge. Students will learn decision making strategies that include ethical analysis by planning and managing resources while adhering to an overall project schedule. As a 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. This class is required for the B.S. degree in mechanical and energy engineering at UNT.

Course Topics:
1. Conceptual Design Process
2. Teamwork
3. Voice of the Customer
4. Product Specification
5. Mechanical Design
6. Public Speaking Skills
7. Ethics

Labs: lab component is satisfied by each student team meeting outside of class to execute specific requirements for project - customer meetings, field trips, research, CAD work, fabrication, testing, etc. F102 Senior Design Lab available for all students, as well as other facilities. Students meet on own schedule. Attendance at official lab section not required.
**ABET OUTCOMES:** This course addresses following ABET program outcomes:

1. ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. 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. ability to communicate effectively with a range of audiences
4. 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. 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. ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. ability to acquire/apply new knowledge, using appropriate learning strategies

**ABET ACCREDITATION GUIDELINES:**

Engineering design process of devising a system, component or process to meet desired needs - iterative decision-making process in which basic science, mathematics, and engineering science applied to convert resources optimally to meet stated objective. Elements of design are establishment of objectives/criteria, synthesis, analysis, construction, testing, evaluation. Engineering design must include: development of student creativity, open-ended problems, development of design methodology, formulation of design problem statements and specifications, consideration of alternative solutions, feasibility considerations, and detailed system descriptions. Essential to include variety of constraints - economic factors, safety, reliability, aesthetics, ethics, and social impact.

**COURSE ADVISOR:**
Course instructors serve as course advisors for all teams. Course advisors provide common consistent syllabus interpretation and common lectures.

**CUSTOMER ADVISOR:**
Many teams have industry advisor (customer) to provide feedback on performance. Student team responsibility to maintain effective communication with customer. Instructor will ask for performance feedback from customer. Customer approves team progress reports.

**FACULTY ADVISOR:**
Faculty advisor provides guidance to specific design and technical mentoring. Serves as customer advisor if team does not have an external customer.
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 to form a team.

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 an 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:
   a. Preliminary Design: research and concept development
   b. Detailed Design: computer engineering analysis using solid modeling FEA
   c. Fabrication: construct using generally accepted engineering fabrication methods and materials.
   d. Test: Instrument, test, and evaluate design and compare to analysis.
   e. Drawings: create detailed part and assembly drawing of component
GRADES

Most assignment dates TBD, meaning each team defines date in project plan. Late submissions lose 1 letter grade per day late. All assignments submitted to CANVAS/presented to instructors. NO email. Standard scale used: 90/80/70. Team and individual components. All members receive same team score for team assignments, unless evidence of non-participation exists. All grades and course assignments are tracked via CANVAS. Students should set up notifications, as required, to help track milestones and deliverables.

Project Planning (10%, Team)
- Project Plan: 10 TBD
- Co-Instructor Conference to review plan: P/F* TBD
- Customer Conference to review plan: P/F* TBD

Mechanical Design Quizzes (15%, individual)
- 15 in class

Project Detail Design (20%, Individual)
- Engineering Analysis: 10 TBD
- Optimization Study: 5 TBD
- Topology Study: 5 TBD

Fabrication and Test (20%, Individual)
- Safety Review and Quiz: P/F* in class
- Basic Practicum: P/F* TBD
- Advanced Practicum: P/F* TBD
- Prototype Hardware Fabrication: 15 TBD
- Prototype Hardware Testing: 5 TBD

Blueprints (15%, Individual)
- Parts Drawings: 10 TBD
- Assembly Drawing: 5 TBD

Customer Reviews
- January Progress Report 1: L* 2/1
- February Progress Report 2: L* 3/1
- March Progress Report 3: L* 4/1
- April Progress Report 4: L* 5/1

Teamwork (individual)
- Peer Evaluation 1: L* 3/1
- Peer Evaluation 2: 5/1

Oral Communication (10%, team)
- Design Day: 4/25
- Final Presentation: 10 5/6-10

Written Communication (10%, team)
- Systems Specification (Final Report): 10 5/2

* P/F (Pass/Fail) and L (Letter grade reductions) grade changes occur based on team peer review, customer feedback, or TA feedback, regardless of current numerical grade per rubric.
TEAMWORK

1. Teamwork is major objective of senior design. Each team member is expected to contribute to 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 should be 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. It should be noted that 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. Your team must find times to meet that are acceptable to everyone in group.

3. Instructors reserve right to reduce student grade based on lack of team work. This includes dropping student, even if all individual grades otherwise passing.

ATTENDANCE POLICY

Responsibility for attendance rests with student. A team cannot succeed if a team member is absent. Student attendance and active participation are “essential”, per UNT policy 06.039 because lack of participation affects entire team. Instructor reserves right to reduce grades and/or drop student from course (grade “WF”) upon accumulation of three unexcused absences from combined total of lectures and labs. Upon accumulating three un-excused absences, a team conference with instructor is required.

Attendance sheet circulated at beginning of lecture (or roll called or iclicker used). It is student responsibility to ensure signing attendance roster during class. No roster changes are made after each class. Lecture arrival after 15 minutes may be recorded as absent. Lab attendance is recorded by signing team meeting minutes. Absence may be excused for following reasons: religious holy day, including travel for that purpose; active military service, including travel for that purpose; participation in an official university function; illness or other extenuating circumstances; pregnancy and parenting under Title IX; and when University is officially closed. Student is responsible for requesting excused absence in writing as early as possible, and personally delivering to instructor to substantiate an excused absence. Late notifications will not be accepted.
ACCESS TO INFORMATION – EAGLE CONNECT

Students’ access point for business and academic services at UNT is located at: my.unt.edu. All official communication will be delivered to your Eagle Connect account. For more information, please visit website Eagle Connect and forward e-mail: eagleconnect.unt.edu/. Instructor only communicate through CANVAS to UNT eagle account.

COURSE SAFETY PROCEDURES

Students required to use proper safety procedures and guidelines in UNT Policy 06.038. While working in laboratory, students required to identify and use proper safety guidelines in all activities. Students should be aware UNT is not liable for injuries incurred while students participating in class activities. All students encouraged to secure adequate insurance coverage in event of accidental injury. Students who do not have insurance should consider Policy 06.049. Brochures for student insurance are available in UNT Student Health and Wellness Center. Students injured during class activities may seek medical attention at Student Health and Wellness Center at rates reduced compared to other medical facilities. If students have insurance plan other than Student Health Insurance, they should be sure plan covers treatment at this facility. If students choose not to go to UNT Student Health and Wellness Center, they may be transported to emergency room at local hospital. Students responsible for expenses incurred there.

ACCEPTABLE STUDENT BEHAVIOR

Course follows student Code of Student Conduct at deanofstudents.unt.edu/conduct.

ACADEMIC INTEGRITY STANDARDS AND SANCTIONS FOR VIOLATIONS

Course follows UNT Policy 06.003. Academic dishonesty will not be tolerated and will result in score of zero on assignment. Student reported to Office of Academic Integrity.

ADA STATEMENT

Course follows UNT learning disability policy at 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

The Instructor reserves the right change syllabus. Any changes will be announced in class and posted to CANVAS with an accompanying email to student’s UNT email address.