**Instructor:** Dr. Mark Wasikowski

**Office Hours:** F101L. W 8-9.30 am, or by appointment.

**Teaching Assistants:** TBD

**Lecture:** MW 10.00 – 11:20; F175 DP

**Class / Lab** - Class and labs share assigned lecture and lab times. Lab attendance is mandatory, but meeting times may vary from registration. Lab sections provide common group time and facilities for project completion, as well as time for field trips to sponsor and CAD work in senior design lab. Generally, only one lecture / week is used. The second lecture is for team meetings.

**Catalog Course Description:** Advanced treatment of engineering design principles with an emphasis on product and systems design, development and manufacture. Mimics “real world” environment with students working in teams to prepare product specification, develop several concepts, perform detailed design, and construct prototypes subject to engineering, performance and economic constraints.

**Course Topics:**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Prerequisite(s): NOT be pre-engineering major and passed:</th>
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<tbody>
<tr>
<td>Teamwork</td>
<td>EENG 2405 or 2610: Circuit Analysis</td>
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<tr>
<td>Engineering Design</td>
<td>MEEN 3100 Manufacturing (Co-requisite)</td>
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<tr>
<td>Project Management</td>
<td>MEEN 3130 Machine Element Design</td>
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<tr>
<td>Communication</td>
<td>MEEN 3210 Heat Transfer</td>
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<tr>
<td>Public Speaking skills</td>
<td>MEEN 3230 System Dynamics and Control</td>
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<td>Safety and Ethics</td>
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**Lecture Topics (Design 1 and 2):** Mechanical Engineering Design Topic options, including solid modeling using Solidworks. FEA examples in solid mechanics, fluid mechanics, thermal heat transfer, mechanical vibration, mechanisms and machines. Systems and Controls design using MATLAB. Lab Safety. Machine Operations and fabrication methods. GDT, CAD drawings, and Assembly Drawings. Presentation Skills. Lecture topics tailored to projects.

**Student Learning Objectives:** This class will address the following outcomes:

a. Formulate design problem, conduct relevant research, develop feasible solutions
b. Develop project management skills: task assignment, cost analysis, purchasing/budgeting, scheduling, time management
c. Carry out component-level design and incorporate it into the system-level design
d. Teamwork, oral and written communication of the preliminary and final results
ABET COURSE TOPICS AND LEARNING OBJECTIVES:

1) Detailed mechanical engineering design using
   a. modern engineering software toolsets and analysis
   b. Fabrication and Testing (4250)
   c. Creating CAD drawings (4250)
2) Teamwork - Gain experience working in teams.
3) Project Management - learn to manage a project in a team environment.
4) Communications - oral and written communication skills
5) Safety and Ethics - safely execute a project in an ethical manner

ABET OUTCOMES: MEEN 4150 addresses following ABET program outcomes:

a) Apply knowledge of mathematics, engineering and science
b) Design and conduct experiments to verify and validate the design projects they develop and analyze and interpret data
c) Develop project-based learning skills through design and implementation of a system, component or process that meets the needs within realistic constraints
d) Function in multi-disciplinary teams
e) Identify, formulate and solve engineering problems
f) Have an understanding of professional and ethical responsibility
g) Communicate effectively
h) Achieve broad education necessary to understand the impact of mechanical and energy engineering solutions in a global and societal context
i) Understand learning processes and need for learning
j) Achieve knowledge of contemporary issues
k) Use techniques, skills and computer-based tools for conducting experiments and carrying out designs
l) Apply principles of engineering, basic science and mathematics to model, analyze, design and realize physical systems, components or processes in both thermal and mechanical systems areas.

ABET ACCREDITATION GUIDELINES:

Engineering design is process of devising a system, component or process to meet desired needs. It is an iterative decision-making process in which basic science, mathematics, and engineering science are applied to convert resources optimally to meet a stated objective. Among fundamental elements of design process are establishment of objectives and criteria, synthesis, analysis, construction, testing and evaluation. The engineering design component of a curriculum must include at the following features: development of student creativity, use of open-ended problems, development and use of design methodology, formulation of design problem statements and specifications, consideration of alternative solutions, feasibility considerations, and detailed system descriptions. It is essential to include a variety of realistic constraints such as economic factors, safety, reliability, aesthetics, ethics, and social impact.
DESIGN SOLUTION REQUIREMENTS

1) Design project must be related to mechanical and/or energy engineering. Project should be the design of a device, machine or system that implements mechanics, thermal, energy, systems, and/or fluids based. Project must have broad enough scope that it demonstrates a student's knowledge of mechanical and energy fundamentals. Projects may include non-mechanical portions such as electronics and instrumentation, but they may not be the primary discipline. Project solutions must involve two or more of the following mechanical engineering disciplines:
   a. Structural mechanics
   b. Fluid mechanics
   c. Machine design / robotics
   d. Energy Systems, HVAC
   e. Thermal systems/ heat transfer
   f. Systems modeling and feedback controls

2) Projects and solutions must be open-ended. A problem with one possible solution is not acceptable. Having many workable solutions allows teams to determine the “best” solution and provide reasoning behind their selection. Multiple alternatives must be presented and evaluated, with an engineering decision process which thoughtfully assesses how to down select to the final design configuration.

3) Projects and solutions are required to have specific constraints which are measurable, i.e., weight, size, cost, performance, efficiency, etc.

4) Projects and solutions must require background research to be done. If the solution has already been published, the project is not acceptable.

5) Projects and solutions should be complex enough to allow each team member to have responsibility for a major design element. If a team can implement a solution, buy a few materials and build it without any engineering analysis to reduce risk or assess capability versus safety or performance requirements - it is not an adequate project. That is not to say that simple solutions for customers are not desired. However, simple solutions require additional scope to provide all students equal opportunity to accomplish all degree requirements. Each student must be provided opportunity to lead the design of major design element or assembly (collection of parts) that requires:
   a. Preliminary Design - research and concept development (4150)
   b. Detailed Design - computer engineering analysis using solid modeling FEA
   c. Fabrication and test - construct using generally accepted engineering fabrication methods and materials. Instrument, test, and evaluate component within design objectives and compare to analysis.
   d. Drawings - create detailed drawings of each part and assembly drawing of component, showing exploded views and Bill of Materials (BOM)

6) 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 test is required.

7) Projects and solutions must be able to be completed by the end of 2018 Fall semester. Adjust scope during course instructor meeting to clearly define reasonable expectations in advance.
TEAMWORK

1. Teamwork is a 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. Teams consist of 3-6 members depending on complexity of project selected and solutions designed. Each project should have enough components to justify team size. More students on a team implies more work performed by team, not less work performed by each student. If a project or solution can be completed with less than 3 students, project solution is not complex enough for senior design. The teamwork element would be missing. Additional scope must be added.

3. 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 the group.

4. Per UNT attendance policy, instructor reserves the right to reduce student grade based on lack of team work. This includes dropping the student from the course, even if all individual grades are otherwise passing.

ATTENDANCE POLICY

Responsibility for attendance rests with student. A team cannot succeed if a team member is absent. Attendance and participation is “essential”, per UNT policy 06.039. 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. Attendance sheet circulated at beginning of lecture (or roll called). 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.
FACULTY ADVISOR:

Each team has a faculty advisor to provide technical guidance related to specific design, provide a good student / faculty ratio, and more in-depth project technical mentoring. Faculty advisors facilitate sign biweekly progress reports, based on having one approximately 30-minute bi-weekly meeting, either individually or as a group. Progress reports without faculty advisor signatures by due dates are zero grade. Schedule faculty advisor meetings in advance to accommodate both student and faculty schedules.

COURSE ADVISOR:

Course instructor as course advisor for all teams. Course advisor provides common consistent syllabus interpretation and common lectures (solid modeling, analysis, safety, fabrication, testing, detail drawings, and assembly drawings) education. Course advisor also signs purchase requests, coordinates lab space, and design day.

INDUSTRY ADVISOR:

Many teams have an industry advisor (customer) to provide regular feedback on performance and decision making. It is the student team responsibility to maintain effective communication with an industry advisor. Instructor will ask for performance feedback with industry advisor at the end of the course.

ASSIGNMENTS:

1) **TEAM MEETINGS**: (ABET d, g, h) at least once / week for project management, schedule planning, presenting results, and decision making. Effective teams meet twice or more / week. All team members present. Meeting minute completed & signed by all members present and retained in binder. Grade: team

2) **TEAM BINDER**: document meeting minutes & research/presentations documenting design decisions. Due 2 May. Grade: team-based

3) **PROGRESS REPORTS**: team progress reports report status, based on bi-weekly faculty advisor reviews. Schedule faculty advisor bi-weekly meetings to review technical progress relative to your plan. Faculty advisor signs team progress report, if acceptable. Progress reports without faculty advisor signatures by due dates are zero grade. Progress reports due to instructor by close of business (COB) Friday's, 2/23; 3/9; 3/30; 4/13; 4/27. Advisor meetings do not need to be held on the progress report due dates - week ahead of due date encouraged. Grade: team-based.

4) **CAD Design Labs**: lectures will present Solidworks CAD solid modeling skills. Student will complete lab exercises in class and/or at home. Grade: individual

5) **CAD Proficiency Exam**: CAD modeling exam review, in class. March 7
6) **Design Day:** attend several 4250 final design presentations on Friday, 27 April. Grade: Individual.

7) **Rapid Prototyping:** 3-d print an assembly of parts of a conceptual design that represents your best design solution by the end of the first semester. Explain how it works during your final presentation. Grade: team.

8) **Engineering Analysis:** perform engineering analysis on a computer for several of your designs. Compare results. Use analysis to help downselect to a final configuration to be built during design 2 (4250). Present results with your final presentation and include in final report. Grade: individual.

9) **Final Presentation:** team based design presentation of your proposed design concepts toward the end of the term. Grade: team.

10) **Final Report:** template on BB, documenting design concepts. Due.

**GRADES**

Assignments have target completion range to accommodate schedule. After target range due date, submissions receive one letter grade reduction per day late. All assignments must be submitted, in writing, to course instructor or TA’s not later than due date. NO emails accepted. TA’s and faculty grade assignments per common instructor rubric. Marks averaged, providing some objectivity to subjective evaluation. Standard scale used: 90/80/70/60. Grade has both team and individual components. All members receive same team score, unless evidence of non-participation of team member. Individual marks can be different.

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<thead>
<tr>
<th>Assignment</th>
<th>Weight</th>
<th>Grade</th>
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<tr>
<td>Team Meetings</td>
<td>20</td>
<td>P/F</td>
</tr>
<tr>
<td>CAD Design Labs</td>
<td>25</td>
<td>P/F</td>
</tr>
<tr>
<td>CAD Proficiency Exam</td>
<td>15</td>
<td>P/F</td>
</tr>
<tr>
<td>4250 Design Day (27 April)</td>
<td>5</td>
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<tr>
<td>Final Presentation</td>
<td>10</td>
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<tr>
<td>Rapid Prototyping</td>
<td>10</td>
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<tr>
<td>Team Binder</td>
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<tr>
<td>Final Report</td>
<td>10</td>
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<td>100</td>
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**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 that explains Eagle Connect and how to forward e-mail:
eagleconnect.unt.edu/. Blackboard is used to post syllabus, homework, lecture slides, grades, etc. Instructor can only communicate through BB to your UNT eagle account

EMERGENCY NOTIFICATION & PROCEDURES

UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In event of university closure, refer to Blackboard for contingency plans for covering course materials.

ACADEMIC INTEGRITY STANDARDS AND SANCTIONS FOR VIOLATIONS

UNT core values of trust, honesty, and integrity are necessary for learning to occur. According to UNT Policy 06.003, Student Academic Integrity, 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 University. Academic dishonesty will not be tolerated and will result in score of zero on the assignment. The student will be reported to Office of Academic Integrity for appropriate disposition. No exceptions.

ACCEPTABLE STUDENT 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. Students engaging in unacceptable behavior will be directed to leave the classroom and be referred to Dean of Students office to consider whether student’s conduct violates Code of Student Conduct. University’s expectations for student conduct apply to all instructional forums, including University and electronic classroom, labs, discussion groups, field trips, etc. The Code of Student Conduct can be found at deanofstudents.unt.edu/conduct.

ADA STATEMENT

UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with Office of Disability Accommodation (ODA) to verify eligibility. If a disability is verified, ODA will provide student with an accommodation letter to be delivered to faculty to begin a private discussion regarding specific course needs. Students may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible to avoid any delay in implementation. Note students must obtain 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 at disability.unt.edu.

RETENTION OF STUDENT RECORDS
Student records pertaining to course are maintained in a secure location by instructor of record. All records such as exams, answer sheets (with keys), and written papers submitted during duration of course are kept for one semester after course completion. Course work completed via BB, including grading information and comments, is also stored in a safe electronic environment for one year. Students have right to view their individual record; however, information about students’ records will not be divulged to other individuals without proper written consent. Students are encouraged to review Public Information Policy and Family Educational Rights and Privacy Act (FERPA) laws and University’s policy.

STUDENT PERCEPTIONS OF TEACHING EFFECTIVENESS (SPOT)

Student feedback is important and essential part of participation. The student evaluation of instruction is a requirement for all organized classes at UNT. The survey will be made available during weeks 13 and 14 of long semesters to provide students opportunity to evaluate how course is taught. Students will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with survey link in their UNT email. Click link and complete survey. Once students complete survey they will receive a confirmation email that survey has been submitted. For additional information, please visit spot website at www.spot.unt.edu or email spot@unt.edu. We will complete SPOT evaluations and ABET forms in class in this course.

SYLLABUS CHANGES

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