INSTRUCTOR: Dr. Mark Wasikowski

OFFICE HOURS: F101L. W 8-9.30 am, or by appointment.

TEACHING ASSISTANTS: TBD

LECTURE: F175 DP
   Section 1: MW 12.30 - 1.50 pm; meets only Wednesday
   Section 2: TR 2-3.20 pm; meets only Thursday

Students on same team need not register for same lecture or lab sections. Only one lecture / week. Eliminated lecture can be used for team meetings, or another time convenient for all team members can be scheduled. Effective teams meet several times per week.

LAB: Each student must register for a 3-hour Saturday Lab team meetings, CAD and fabrication. Teams free to meet outside of these times instead. Some Saturday lab times will be required. Teams must let instructor know team lab times in the team project plan.

COURSE CATALOG DESCRIPTION: (0:9) 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 team's 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 B.S. degree in mechanical and energy engineering at UNT.

PRE-REQUISITE: MEEN 4150 (with a grade of C or better)

COURSE TEXT: None

ABET COURSE TOPICS AND LEARNING OBJECTIVES:
1) Detailed mechanical engineering design using
   a. modern engineering software toolsets and analysis
   b. Fabrication and Testing
   c. Creating CAD drawings
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 4250 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
   e. HVAC
   f. Thermal systems/ heat transfer
   g. 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. Detailed Design - computer engineering analysis using solid modeling FEA
   b. Fabrication and test - construct using generally accepted engineering fabrication methods and materials. Instrument, test, and evaluate component within design objectives and compare to analysis.
   c. 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 Spring 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 3-5 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 teamwork. 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 (Dr. Wasikowski) serves 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.

REASONABLE ACCOMMODATION:

Reasonable accommodation of schedule is necessary from both students and MEE department. If student can't provide reasonable accommodation, instructor should be notified immediately. Generally, some Friday and Saturday participation are necessary.

MEE department agrees to provide reasonable accommodation by:
1) Only one lecture per week. While team is not required to meet during eliminated lecture, this does provide guaranteed a team meeting time
2) Provide open CAD labs in F102D with teaching assistants for CAD help
3) Provide lab safety and machine tool training. Typically, Friday or Saturday
4) Provide lab student access both during day, nights, and weekends
5) Provide free Solidworks licenses for student home use
6) Provide tools (hand tools and small power tools) for check-out

Student agrees to provide reasonable accommodation by:
1) Determine common consistent weekly meeting times for all team functions, including team meetings,
2) Attend team meetings with faculty / course advisor outside of class time
3) Attend fabrication practicums, outside of scheduled class times
4) Attend design day on Friday, 27 April. Attendance all day is required
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 (Section 1) and 3 May (Section 2). Grade: team-based

3) **PROJECT PLAN**: (ABET c, h, i) Prepare a project plan as a team. Plan has both team and individual components. Project plan template is available on BB. Schedule 1-hour team meeting (all team members present) with course instructor to review the plan. Scope may be increased, remain same, or decreased. Reviews are scheduled 1st come, 1st served through MEE office, Friday 26 (7am-8pm) or Saturday 27 Jan (7am - 6 pm) Grade: both team and individual components.

4) **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, 2/2; 2/16; 3/2; 3/23; 4/6; 4/20. Advisor meetings not need to be held on progress report due dates - week ahead of due date is encouraged. Grade: team-based.

5) **DESIGN REVIEW**: (ABET k, l) Each student review computer engineering analysis results with your faculty advisor during one of your meetings. Apply mathematics, engineering and science to model and analyze physical systems, components or processes - SolidWorks/MATLAB/E-Quest. Each student must complete, per project plan. Target range is 12 Feb - 2 March. Grade: individual

6) **FABRICATE** (ABET b, l): Teams use generally accepted manufacturing methods and materials (metals, ceramics, composites, polymers). 3-d printing, play doe, and similar techniques are specifically excluded. Fabrication must take place at UNT and/or sponsor facility, not at home etc. Fabrication options, in preference order, are 1) actual product/process for customer, 2) fixtures/tools used to manufacture product/process, 3) fixtures/tools used to test product/process, or 4) scale model of related product/process. Each student completes fabrication of your assembly. Team demonstrates design to instructor / TA’s. Reviews scheduled 1st come, 1st served through MEE office. Target range 26 March - 14 April. Each student is responsible for fabrication of an assembly of parts.

   a. Attend lab safety lecture and pass lab safety quiz. Grade: Individual
b. Complete basic shop safety practicum, either through EMF or MEE, in practical shop safety and operation of horizontal saw, band saw, drill press, grinders, and belt sanders. Target Range: 5 Feb - 2 March. Grade: Individual
   i. EMF, generally Friday’s 12-4 pm, 4-8 students
   ii. MEE, evening or Saturday appointments, 4-8 students

c. Complete one advanced practicum in either EMF or MEE. Target Range: 12 Feb - 9 March. Grade: Individual
   i. MEE Lathe / Mill (desktop Grizzly’s)
   ii. Sheet Metal (bending, rolling, shearing, pipe notching & bending)
   iii. Welding (MIG, TIG, or aluminum)
   iv. EMF Lathe / Mill (requires EMF shop safety)
   v. Composite Material Fabrication

d. Complete purchase orders. Forms are on BB. All major purchases should have been included in a cost estimate in your project plan. Analysis may be required to justify a purchase, depending on cost and risk. Course instructor approves purchase orders. Lab manager executes purchase orders.

7) TEST: (ABET b): Design and conduct experiments to verify and validate the design projects developed and analyze and interpret data. Use techniques, skills and computer-based tools for conducting experiments and carrying out designs. Conduct experiment to verify/validate design hardware works by comparing measured data with analysis. Demonstrate to instructor / TA’s. Scheduled 1st come, 1st first served, through MEE office. Target range 1 April - 21 April. Grade: team

8) DESIGN DAY AND PRESENTATION (ABET f, g, j): Present your design to the public for review, Friday 27 April, all day at Discovery Park, in a conference / trade show type format. Give a 30-minute technical presentation on your design. Grade: team

9) CAD DRAWINGS (ABET c, g, k, l): Each team member create a drawing of each part in the assembly you are responsible for, plus one assembly drawing of your entire assembly. Part drawings should have dimensions sufficient to permit fabrication, including GDT dimensions, along all standard views (side, front, top, isometric, detail, and auxiliary). Assembly drawing contain no dimensions, but do contain fabrication notes, an exploded view showing assembly process, and materials list. Due 2 May (Section 1) and 3 May (Section 2). Grade: individual

10) FINAL REPORT: (ABET g, h, i, j): Document all results in a final report. Final report template available on BB. Start with 4150 final report, and add the remaining sections to document engineering design analysis performed using computer software, fabrication results, parts drawings, and assembly drawings. Address remaining ABET requirements. Compare test results to analysis.
**SCHEDULE:** (lectures generally lead project application)

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<th>Grade Type</th>
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<th>Section 2 Date</th>
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<tr>
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<td>Team</td>
<td>16 - 19 Jan</td>
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<td>Team Meeting 2</td>
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<td>20 - 26 Jan</td>
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<td>Team Meeting 3</td>
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<td>Instructor Conference</td>
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<td>Team Meeting 4</td>
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<td>Progress Report 2</td>
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<td>Fabrication Practicum 1</td>
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<td>Design Review</td>
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<td>Fabrication Practicum 2</td>
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<td>Fabrication Demo</td>
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<td>Final Report</td>
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<td>Team Binder</td>
<td>Team</td>
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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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<td>Fabrication Demonstration</td>
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<td>2x Fabrication Practicums</td>
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<td>Shop Safety Quiz</td>
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<td>Teamwork</td>
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ACADEMIC INTEGRITY STANDARDS AND SANCTIONS FOR VIOLATIONS

UNT core values of trust, honesty, and integrity are necessary for learning. Per policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in, but not limited to, cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, sabotage. A finding of academic dishonesty may result in range of academic penalties/sanctions ranging from admonition to expulsion. Academic dishonesty is not tolerated and will result in 0 on assignment and reported to Office of Academic Integrity. No exceptions.

ACCEPTABLE STUDENT BEHAVIOR

Student behavior that interferes with instructor’s ability to conduct class or other students' opportunity to learn is unacceptable / disruptive and will not be tolerated. Students engaging in unacceptable behavior will be directed to leave classroom and referred to Dean of Students office to consider whether 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. Code of Student Conduct can be found at 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 will be delivered to your Eagle Connect account. For more
information, visit website that explains Eagle Connect and how to forward e-mail: eagleconnect.unt.edu/. All forms, data, assignments, etc. are posted to BB.

ADA STATEMENT

UNT makes reasonable accommodation for students with disabilities. Students seeking accommodation must register with Office of Disability Accommodation (ODA) to verify eligibility. If disability verified, ODA provide student with letter to be delivered to faculty to begin private discussion regarding specific needs. Students may request accommodations at any time, however, ODA notices of accommodation should be provided early as possible to avoid delay. Obtain new letter of accommodation every semester and meet with faculty prior to implementation. For additional information see ODA website at disability.unt.edu.

EMERGENCY NOTIFICATION & PROCEDURES

UNT uses Eagle Alert to quickly notify students with critical information in event of emergency (i.e., severe weather, campus closing, health and public safety emergencies). In event of closure, refer to BB for contingency plans for covering course materials.

RETENTION OF STUDENT RECORDS

Student records are maintained in secure location by instructor. All records such as exams, answer sheets (with keys), written papers submitted during duration of course are kept for one semester after course completion. Course work completed via Blackboard, including grading, stored in safe electronic environment for one year. Students have right to view individual record; however, information about students’ records will not be divulged to other individuals without proper written consent. Students 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. Student evaluation of instruction is requirement for all organized classes. Survey will be available during weeks 13 and 14 of long semesters to provide with opportunity to evaluate how course is taught. Students receive email from "UNT SPOT Course Evaluations via IASystem Notification" (noreply@iasystem.org) with survey link. Students look in UNT email inbox. We will complete SPOT evaluations and ABET forms in class. Once students complete survey they will receive confirmation email survey has been submitted. For additional information, visit spot website at www.spot.unt.edu or email spot@unt.edu.

SYLLABUS CHANGES

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