UNIVERSTY OF NORTH TEXAS SYLLABUS
MEEN 4250 *Capstone Design in Mechanical and Energy Engineering*
SPRING 2020. 3 Credit hours

Course Instructors: Dr. Parham Zahedinejad and Dr. Hassan Qandil
Program Facilitator: Dr. Wasikowski
Teaching Assistants: Zane Hughes and Andrew Renzetti

Lectures:
1. MW 12.30 - 1:50, NTDP F175
2. TR 2 – 3:20, NTDP F175

Prerequisite(s): complete following with grade of 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 (MEE) 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.

Major Design Experience: MEEN 4250 completes an ABET requirement for a student Major Design Experience. Per ABET: "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 the purpose of obtaining a high-quality solution under the 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"

Labs: 2 lab components
1. Recitations to practice CAD / CAE / DFA / DFM / CAM / GDT. 1 hr / week in F102
2. Team / Customer meetings, fabrication, testing, etc. Meet on own schedule.
3. Attendance at registrar enrolled lab section time not required.

ABET OUTCOMES

1. Identify, formulate, and solve complex engineering problem by applying principles of engineering science and mathematics.
2. Apply engineering design to produce solutions to meet specified needs with consideration of public health, safety, welfare, global, cultural, social, environmental, economic factors
3. Communicate effectively with a range of audiences.
4. Recognize ethical/professional responsibilities in engineering situations and make informed judgements, which must consider impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on team whose members together provide leadership, create a collaborative/inclusive environment, establish goals, plan tasks, meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
7. Acquire and apply knowledge as needed, using appropriate learning strategies.

LEARNING 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 through written reports and presentations

COURSE TOPICS:

1. CAE - Computer Aided Engineering: detail design analysis using solid models
2. DFM/DFA - Design for Manufacturing & Assembly: materials and manufacturing processes, including Computer Numerical Controlled Machines (CNC)
3. GDT - (Geometric Dimension and Tolerance) blueprint making

GRADE: Standard used: 90/80/70. All members receive same score for team assignments, unless evidence of non-participation exists.

Attendance / participation	individual	10	weekly
Project Plan	team	10	TBD
Lab Quizzes	individual	10	weekly
CAE Design Analysis	individual	10	TBD
Prototype Fabrication	team	25	TBD
Prototype Test	team	10	TBD
Blueprints	individual	15	TBD
Oral Communication – Presentation	team	5	TBD
Written Communication – Report	team	5	TBD
Customer, Team, Instructor Evaluation	individual	L*	monthly
Design Day participation	individual	L*	4/17
Safety	individual	P/F*	TBD

* P/F (Pass/Fail) & L (Letter grade) changes can occur, regardless of grade per rubric.

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 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

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. Upon accumulating three un-excused absences, a team conference with instructor is required. 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.

Roll called near beginning of class. Late arrival may be recorded as absent. Lab attendance and progress met by weekly on-line progress reports.

Absences may be excused for UNT recognized 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.

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.