ME 461/462: Design Project I, II (3 credits each) **Spring 2011**

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Office Hours: Monday 1-2:30pm, Thursday 1:30-3pm, or by appointment

Required for Class: Laboratory/Computation Notebook – Example: Avery S/N 43-648 (available at the NDSU Bookstore) or National 43-648

Prerequisites: Co-requisite for ME 461; ME 442, ME 454, senior standing in ME. Prerequisite for ME 462: ME 461 and admission to the professional program. Courses must be taken in consecutive semesters. Summer classes are based on minimum enrollment.

Catalog Description: Capstone student project in design, analysis, and experimental investigation in mechanical engineering.

Course Objectives:
This two-semester senior level capstone design course involves a collaborative group effort to complete a design project. This will include the planning, design, and analysis of a product or system, and may include the manufacture and testing of a prototype. Technical communication, both written and oral, is also emphasized.

Topics Covered:
1. Problem identification and definition
2. Synthesis and creativity
3. Time management and scheduling
4. Analysis and troubleshooting
5. Use of basic engineering, mathematics, and science principles
6. Use of computer tools (word processing, spreadsheets, general mathematics packages, CAD, finite elements, dynamic simulation, thermodynamics and fluid dynamics packages, statistical, data analysis, graphing, etc.)
7. Economic considerations; manufacturability and maintainability
8. Testing and evaluation methods
9. Safety and product liability concerns
10. Written and oral communication

Class Schedule:
The following table displays some of the topics covered and a tentative schedule for ME 461to be held on Tuesdays each week. The schedule for ME 462 will be less defined and more under the control of the mentors. However on occasion, the instructor will call together the ME 462 students for a joint meeting to be held on Thursdays. E-mails will be used for notification. Usually a one week notice will be given.

Topic	Details	Lessons
Introduction	why, organization, expectations, deliverables, etc.	1
Notebook	what's the purpose / importance of detailed notes	1
Project Plan	steps in developing meaningful project plans, MS project, etc.	1

Budgeting	how to structure budgets / paperwork required for ME office	1-2
Agenda Development	how to structure weekly meetings	1
Team Dynamics	how to work in groups	1
Management	different types & structures	2-3
Presenting	techniques & importance	1
Law/Liability	liability, patents, intellectual-property, etc.	2-3

Grading Policy:
Grading will be accomplished by a collaboration of the instructor and project mentors. The mentors will assign approximately 80% of your grade while the instructor is responsible for the remaining 20%. The table below described the areas of interest for each grader.

Grading Categories	**Graded By**	**Weight %**
Class Participation	Instructor	5
Weekly Performance &/or Meeting Contributions	Mentor	10
Weekly Lab Notebook	Mentor	20
Project Plan & Budget	Mentor + Instructor	15 + 5
Oral Presentations	Mentor + Instructor	15 + 5
End of Semester Report	Mentor + Instructor	20 + 5
Total		**100**

Contract Grades:
≥90% A
≥80% B
≥70% C
≥60% D
<60% F

Required Activities:
Since this is a three credit course, it is expected that each student in each group will spend approximately 9 (or more) hours per week working on course activities. These activities will include:

- **Weekly meeting with mentor:** Groups are expected to establish a regular meeting time with their mentors and meet at least *one hour* per week.
- **Cooperation with mentor and other group members**
- **Cooperation with clients (if applicable)**
- **Attend weekly seminars for ME 461, and as-required in ME 462 with prior notification**
- **Participation in design project work**
- **Complete the following major course items each semester:**
  - **DESIGN NOTEBOOKS:** Each student in ME 461 & ME 462 will be graded on a Design Notebook. It will be a bound collection of numbered pages with space for two signatures on each page, such as Avery S/N 43-648. You will bring these notebooks to each weekly mentor meeting for his/her signature on filled pages. Throughout each semester, your mentor will grade these and return them to you periodically and will keep them at the end of the project.

- **Project Plan:** Due **February 11th by 5pm** for ME 461, includes preliminary discussion of project plan with associated time line. One hard copy, each, to your mentor and the instructor, and an electronic copy submitted to the respective group folders on the MEAM Group server.
- **Budget:** Due **March 11th by 5pm** for ME 461, includes a formal, detailed budget and budget justification. One hard copy, each, to your mentor and the instructor, and an electronic copy submitted to the respective group folders on the MEAM Group server.
  ***NOTE**: No purchases will be reimbursed without an approved budget on file!
- **Revised Project Plan & Budget:** Due **1 month into the fall semester** for ME 462, includes a revision of both the project plan and budget as they have evolved from the first semester work into the second semester of senior design. One hard copy, each, to your mentor and the instructor, and an electronic copy submitted to the respective group folders on the MEAM Group server.
- **Oral Presentations**. During dead week prior to final examinations for both ME 461 & ME 462. Sign-up schedule to be posted later. The oral presentations will summarize the work performed to date on the design project, including conclusions and recommendations, detailed instructions to be provided later. All students must give an equitable portion of the presentation. One hard copy, each, of slides in handout form to your mentor and the instructor, and an electronic copy of entire PowerPoint presentation submitted to the respective group folders on the MEAM Group server at the start of the presentation. All students are expected to attend and evaluate, at a minimum, four other presentations.
- **Final Report**: Due at the start of the oral presentation. The final written report should document all aspects of the design project, including the background and objectives of the project, design methodologies utilized, preliminary design concepts, analysis and testing performed, details of final design selection, final budget and cost analysis, and conclusions and recommendations for future work. More detailed instructions will be provided later. One hard copy, each, to your mentor and the instructor, and an electronic copy submitted to the respective group folders on the MEAM Group server. Electronic copy includes all computer files, including drawings, reports, patent applications, etc.

Course Attendance:
According to NDSU Policy 333 (http://www.ndsu.nodak.edu/policy/333.htm), attendance in class is expected. Only the course instructor can excuse a student from course responsibilities (the term "course" includes class, laboratory, field trips, group exercises, and/or other activities).

Special Needs:
Any students with disabilities or other special needs, who need special accommodations in this course are invited to share these concerns or requests with the instructor as soon as possible.

Academic Responsibility:
All work in this course must be completed in a manner consistent with NDSU University Senate Policy, Section 335: Code of Academic Responsibility and Conduct (http://www.ndsu.nodak.edu/policy/335.htm) and the CEA Honor System available at http://www.ndsu.nodak.edu/ndsu/cea/

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Course Outcomes and Relationship to Program Outcomes:

No.	Course Outcome	Affected Program Outcomes
1.	Students must be able to identify, formulate, and solve fundamental engineering problems.	e
2.	Students must be able to select materials for the required application.	l
3.	Students must be able to design a system, component, or process to meet desired needs.	b, c
4.	Students must be able to use techniques, skills, and modern engineering tools necessary for engineering practice.	k
5.	Students must be able to perform analysis of physical systems, create, and validate models that correctly represent such systems to reflect current industry practices.	m
6.	Students must be able to work on (multidisciplinary) teams.	d
7	Students must be able to communicate effectively engineering concepts and results.	g
8	Students must understand professional and ethical responsibility.	f
9	Students must be able to engage activity that will prepare them for life-long learning with consideration of the impact of their design on society. These activities could include but are not limited to: literature and internet searches, communication with staff of the institution, clients, and vendors.	i, h

Affected Program Outcomes:

a) Graduates must have the ability to apply knowledge of mathematics and science to solve engineering problems.
b) Graduates must have the ability to design and conduct experiments as well as to analyze and interpret data.
c) Graduates must have the ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) Graduates must have the ability to function on multidisciplinary teams.
e) Graduates must have the ability to identify, formulate, and solve fundamental engineering problems.
f) Graduates must have an understanding of professional and ethical responsibility.
g) Graduates must have the ability to communicate effectively.
h) Graduates must possess the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) Graduates must recognize the need for, and possess an ability to engage in, life-long learning.
j) Graduates must possess knowledge of contemporary issues.
k) Graduates must have the ability to use techniques, skills, and modern engineering tools necessary for engineering practice.
l) Graduates must have the ability to identify a suitable model for a physical system, and apply principles of mechanics, thermodynamics, fluid mechanics, and materials to obtain a solution that satisfies the constraints.
m) Graduates must be able to analyze a physical system, and create and validate models based on engineering and mathematical principles that correctly represent such systems and reflect current industry practices.