MET 435
Senior Design Project
Course Syllabus

INSTRUCTOR: Alok K. Verma
OFFICE: KH 108-B
PHONE: (757) 683-3766
E-mail: averma@odu.edu
Home Page: www.lions.odu.edu/~averma/

DAY/TIME: M: 12:00-12:50
Spring 2006, GORNT-218
Office Hrs: M, W; 11:00 am-11:50 am
Office Hrs: R; 5:45 pm-7:00 pm

Course Background:
MET 435, the senior design project course, is a capstone course required of all students in the MET program. This is an independent study type course requiring extensive research, analysis, prototyping, testing and evaluation. Students will have completed a wide variety of technical courses by their senior year and will have the background necessary for the completion of a comprehensive design project. The senior design project is completed under the guidance of a MET faculty member who serves as the course director.

A typical project starts with several weeks of intensive investigation and analysis of an engineering or manufacturing problem. The initial investigation will be followed by a combination of conceptual design, engineering calculations, computer-aided drafting, analysis, material selection, building prototypes, testing, modifications and detailed design. Students are required to prepare a final report with appropriate CAD drawings and make an oral presentation to department faculty and other engineering technology students.

Students are expected to maintain a log book to document the progress and time invested in the project. A student is expected to spend a minimum of nine hours per week to successfully complete their project.

Students are responsible for all expenses associated with their project including, but not limited to, acquiring and/or purchasing materials necessary for the completion of the project (except in situations where funded by a company). If the result of the project is equipment or laboratory support materials which will be retained by the department for future use, some financial assistance may be available from the school. It is essential to identify the source of financial support during the first few weeks of the semester.

Course Description:
ODU Catalog description of the course: MET 435W. Senior Design Project. Lecture 1 Hour; Laboratory 6 Hours; 3 Credits.
Prerequisites: senior standing. A capstone course exercising upper level course work involving independent or group design projects. Students are required to collect data and synthesize a mechanical design. Submission of written reports and a final oral presentation are required.

Contact policy:
The best way to communicate with me is to use my university email address. I will be in my office during the scheduled office hours unless other university obligations conflict with these hours. I usually respond to voice phone messages within two days.
Internet address (URL) for my website: http://www.lionsd.odu.edu/~averma/
Notes on the project course:

- Part of your grade on the senior project is determined by how you plan the scheduling and how well you keep it on schedule. Therefore, your project must have a schedule that you control, not your employer. For this reason, "on-the-job" senior projects are discouraged. If you feel strongly about doing an on-the-job project, contact the course instructor. Additionally, we are unable to sign non-disclosure agreements on Senior Projects (i.e., you must have complete freedom to submit all documentation without the university entering into any legal agreements).
- You may work on the project either alone, or in two-person teams. If you work as a team, you will submit one project, one report, and one video presentation. You must equally share in the effort for each. Keep in mind that the expectation for a team effort is approximately twice that for an individual.

Note: This class is delivered to students on campus, as well as students off campus via satellite. It can also be video streamed.

How to be successful in this course:

- You should have your proposal identified and in, by the specified date.
- Attend all scheduled lectures.
- Submit all homework assigned to you during these lectures.
- There will be a multiple choice final examination on this material.
- Do not miss the final examination, mark your calendar since the final examination will not be during the final exam week.
- Do not delay all the work towards the end of the semester.
- Document all your work.
- Seek guidance whenever needed.
- Your project must be typed and well organized as a professional technical report.
- Your drawings must be done in CAD.
- Submit your material on time.
- Prepare your power point presentation of your project, not to exceed 8 minutes (you should rehearse and time your self).
- Off campus students should make sure that their projects are submitted on time and dated by the sire director. Limit your video presentation to less than 15 minutes.

Course Objectives:

The primary objective of this course is to introduce students to the design of mechanical engineering systems and to include teamwork, communication, economic and safety considerations in design. Another objective is to develop liaison with industrial partners whenever possible. In doing so, students will use methods developed for the design of mechanical engineering systems and components, including problem definition, analysis, synthesis and optimization.

Educational Objectives:

As a student you will:
1. Develop skills in application of engineering principles to open-ended projects.
2. Demonstrate the ability to use computers for engineering purposes.
3. Demonstrate ability to work in teams.
4. Learn to effectively communicate engineering designs, both verbally and in writing.
5. Learn to interact with industrial participants and vendors.
6. Learn the importance of economics in engineering.

**Expected Outcomes:**
1. Ability to apply knowledge of mathematics, science, and engineering
2. Ability to design and conduct experiments, and to critically analyze and interpret data
3. Ability to design a system, component or process to meet desired needs
4. Ability to function in multi-disciplinary teams
5. Ability to identify, formulate and solve engineering problems
6. An understanding of professional and ethical responsibility
7. Ability for effective oral and written communication
8. The broad education necessary to understand the impact of engineering solutions in a global and societal context
9. A recognition of the need for, and an ability to engage in life-long learning
10. A knowledge of contemporary issues
11. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

**Feedback to Instructor:**
Students are encouraged to express their opinion about all aspects of the course. Students may make suggestions via e-mail or in person during office hours. The final course evaluation form will be sent to the student via email.

**Schedule of Lectures:**

Meeting Time: Monday  12:00-12:50

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture</th>
<th>Assignment Due</th>
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<tbody>
<tr>
<td>1/9</td>
<td>Introduction</td>
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<tr>
<td>1/16</td>
<td>Holiday (No class)</td>
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<tr>
<td>1/23</td>
<td>Codes and Standards</td>
<td>Submit Project Proposal</td>
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<tr>
<td>1/30</td>
<td>Codes and Standards</td>
<td>Revised Project Proposal and Timeline</td>
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<tr>
<td>2/6</td>
<td>Ethics</td>
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<tr>
<td>2/13</td>
<td>Technical Writing</td>
<td>Ethics Assignment -1</td>
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<tr>
<td>2/20</td>
<td>Resume Writing</td>
<td>Technical Writing Assignment - 2</td>
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<td></td>
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<td>Status Report # 1</td>
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<tr>
<td>2/27</td>
<td>Intellectual Property Rights</td>
<td>Resume Assignment - 3</td>
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<tr>
<td>3/6</td>
<td>Spring Break (No class)</td>
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<tr>
<td>3/13</td>
<td>Engineering Technology &amp; Professional Registration</td>
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<tr>
<td>3/20</td>
<td>Final Exam</td>
<td>Status Report # 2</td>
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<tr>
<td>3/27</td>
<td>No Class</td>
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<td>4/3</td>
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<td>4/10</td>
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<td>4/17</td>
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<tr>
<td>4/24</td>
<td>No Class</td>
<td>Final Report and Presentation</td>
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How the Course Works:

1. The student should identify a potential project and initiate discussion with the appropriate MET faculty member. Typically, project ideas come from the following sources:
   a) Projects that involve further investigation of a subject area discussed in a prior technical course.
   b) Projects that involve a technical area in which the student has no prior coursework or experience.
   c) Projects that involve solving a real-world problem in the student's home or place of employment.
   d) Projects proposed by department faculty members.

2. With verbal agreement from a faculty member, the student prepares a Senior Project Proposal (format attached) and submits it to the faculty member for approval.

3. The student and faculty member will establish means of communication.

4. All necessary laboratory access requirements, equipment needs, and computer support will be determined and arranged with the assistance of the machine shop technicians.

5. The student will maintain an engineering logbook that will show day-to-day progress on the project. The log book should include any work associated with the project such as, but not limited to, conceptual ideas, design sketches, calculations, technical references, professional contacts, component sources, software information, etc. The logbook should be dated and signed.

6. A thorough literature search should be conducted to find information pertinent to the project. Additionally, a patent search should be conducted when appropriate.

7. Students are required to submit two status reports during the semester on the specified dates.

8. The student should submit the final report at least a week before the end of the semester. The average length of a senior design report is 20 to 30 pages excluding appendix material.

9. The student will make an oral presentation to department faculty and students during the last week of the semester. Distant students should submit a video presentation. Presentations must not exceed 15 minutes.

10. The final grade for the senior design project course will be determined by the following factors:
    a) Quality and magnitude of work.
    b) Log book, homework and special assignments
    c) Final report.
    d) Oral presentation.
    e) Final exam.

Senior Project Proposal Format (One Page):

Name _________________________________ Course Number MET 435
Project Title ___________________________
1. **PROBLEM**: Definition and limits of problem area.
2. **PURPOSE and OBJECTIVES**: Explanation of your interest in pursuing the project; why the area is of concern to you; and what you hope to learn and accomplish.
3. **PROCEDURE**: Explanation of the methods you expect to use and any requirements for materials, equipment, or facilities.
4. **OUTCOMES**: Explanation of anticipated results of the project.
5. **SCHEDULE**: Proposed time schedule in weeks that includes all aspects required to complete the project.

Student signature __________________________ Date _____________
Faculty advisor signature ____________________ Date _____________

**Recommended Task Schedule:**

The task schedule given below is an example and may vary from project to project depending upon the scope of the project.

**Week 2** Identify the project that you will be working on.

**Week 3** Begin calling as many vendors as possible to obtain product catalogs.

You may want to use the Thomas Register books found in the library or use the Internet Thomas Register at www.thomasregister.com

**Week 4** Problem Description:

1. Describe the problem you're trying to solve from an historical perspective.
2. Sketch 5 possible design ideas that would be solutions to the problem.
3. Use one page per sketch.
4. Be sure to annotate each sketch so as to provide the reader with as much information to understand your idea.

**Week 5** Choose the best design. From the 5 design sketches created during week 4, choose the best design. All of the catalogs should be in by now.

**Week 6** Design all of the special features of the parts.

1. If you are using pneumatic components such as cylinders and valves you should know what size of cylinder you need, what type of valve will you use, what will be the source of air flow, what pressures do you need, etc

2. Other components such as mechanical or electronic devices should be identified at this point. If you discover that you need a certain type of bearing and you do not have a catalog on that bearing then order the catalog so you will have the necessary information.
Week 7 & 8  Assembly and Detail drawings: All of the assembly and detail drawings need to be completed in these two weeks

Week 9  Purchase part list: Every component that you specify to be used on your design must be listed in the parts list. Use the following format.

<table>
<thead>
<tr>
<th>Part #</th>
<th>Part Description</th>
<th>Unit Price</th>
<th>Total Cost</th>
</tr>
</thead>
</table>

Week 10  All of the material needed to assemble your design should have arrived by now and you should begin making any modifications necessary for assembly. Any machine shop, welding or soldering work should be done during this week.

Week 11  Assembly and testing of your design is conducted during this week. Collect all data necessary to evaluate your design.

Week 12  Redesign and Review: Here you will need to identify any flaw found in the testing phase in the previous week.

1. The results of the testing should be tabulated
2. All accompanying graphs should be drawn for analysis.

Week 13  Ordering of new parts: Now that you have seen the flaws in the previous design you will need to make modifications to the design. These modifications may require you to order new parts or make other adjustments. Remember to reflect these changes in your CAD drawings, and note them as revisions.

Week 14  Rebuild and retest your new designs.

Week 15  Submit final report and make an oral presentation (or submit video presentation).

Grading Criteria:
1. Technical contents and final report.................... 50%
2. Homework and special assignments..................... 15%
3. Status reports...................................................... 10%
4. Oral presentation.............................................15%
5. Final exam.................................................. 10%

Deliverables:
1. Status reports 1 & 2
2. Home work assignments
3. Final report
4. Engineering log book
5. CD containing project presentation
**Status Report:**

A continuation (and update) of your milestone table and describes what you have accomplished and what is yet to be accomplished. (Which goals have been met, what delays you've experienced, how you plan to make up the lost time, where you expect to be, etc.)

**Standard Technical Report Format:**

One outcome of the senior design project is a technical report. This technical report will be retained by the department and used for future reference by both faculty and students so it must be professionally prepared, following standard technical report writing guidelines. The report will be graded on grammar, spelling, technical content, and technical writing format.

1. **Title Page:** A single sheet which lists the project title, name of student(s), faculty advisor's name, course and section number, date, and any other pertinent information.
2. **Letter of Transmittal:** A single page letter submitting the report for consideration by your faculty advisor that is signed and dated.
3. **Table of Contents:** A single page identifying each section of the report as well as appendices.
4. **Abstract or Executive Summary:** No more than one page which summarizes the project including the problem, objective, procedure, and outcomes. The reader should be able to read this single page and understand the scope and results of the project.
5. **Introduction:** A complete description of the project that defines and explains the problem, purpose, objectives, assumptions, historical background, and general make-up of the report.
6. **Literature Search:** The results of the literature search and patent search should be presented. Any pertinent material should be placed in an appendix and referenced in this section. All references should be listed in the bibliography.
7. **Equipment List:** This is a listing of laboratory equipment, instrumentation, engineering software, and/or manufacturing equipment that was used during the project. Included in the list should be the type of equipment, model number, and a short description. Photographs and/or drawings should be included where appropriate. Computers and software used for the report presentation should not be listed.
8. **Discussion:** This section presents a complete and through discussion of the project in terms of procedure used, engineering calculations, laboratory experimentation, design analysis, financial analysis, computer-aided engineering analysis, and any other pertinent information. A discussion and analysis of the results should also be included. Representative calculations should be included in this section with complete sets of data included in the appendices. Figures, graphs, and photographs are appropriate and encouraged and must be identified with captions and referenced in the text. Engineering drawings should be included in the appendices and referenced in this section.
9. **Conclusion:** Included in this section is a discussion of the results of your project. This section may include problems experienced during the project, recommendations for further work in the area, recommendations on how the project could be approached differently by future senior design students.
10. **Bibliography:** All references should be included using standard citation format.
11. **Appendices:** The section should be organized by material type and include all reference materials, computations, data, supporting materials, computer analysis results, sales brochures and engineering drawings.
**Formatting Instructions:**

1. Section headings should be capitalized and underlined with 12-point font.
2. Body of the report should be single spaced 11-point font.
3. Top, right-hand, and bottom margins should be 1".
4. Left-hand margin should be 1".
5. Each page should have the heading "Department of Mechanical Engineering Technology" in 10-point font, right justified.
6. Each sheet (except the title page) should have a page number that is centered.
7. The report including appendices should be bound. Drawings larger than B size can be left unbound.
8. Table, figures, photographs, graphs, etc. must be identified with a caption.
9. References should be identified in the text with bracketed numbers. For example [1].
10. All engineering drawings should be prepared using 3-dimensional modeling.
11. Students are encouraged to submit a copy of their report, computer analysis, and drawing in digital format on a CD-ROM.

**Oral Presentation:**

Each student is expected to make an oral presentation to the department faculty and other engineering technology students. This oral presentation should be professional and utilize good technical presentation techniques. Audio-visual equipment will be available for student’s use by prior notification to the faculty advisor. The presentation must not exceed 15 minutes. The presentation should be structured to include all aspects of the project so that an individual with no prior knowledge of the project can understand its entire scope as well as the results. Distant students can submit a video presentation not to exceed 15 minutes. Accepted video formats are VHS, VHS-C, and any CD formats (mpeg, avi, Quicktime etc.).

**Student Responsibilities:**

a. Time management
   i. In this course, you are highly encouraged to:
      1. think and plan your individual learning process;
      2. clarify and set your own goals;
      3. monitor and assess your own progress;
      4. establish criteria for judging your own performance;
      5. work alone and collaborate with other students as appropriate.
   b. Reading and understanding the syllabus
   c. Utilizing online components where applicable
      i. Checking email
      ii. Checking for revisions to course web site.

**Special Needs**

In compliance with PL94-142 and more recent federal legislation affirming the rights of disabled individuals, provisions will be made for students with special needs on an individual basis. The student must have been identified, as "special needs" by the university and an appropriate letter(s) must be provided to the course instructor. Provision will be made based upon written guidelines from the university "special needs students" resource office. All students are expected to fulfill all course requirements.
Honor Pledge
"I pledge to support the honor system of Old Dominion University. I will refrain from any form of academic dishonesty or deception, such as cheating or plagiarism. I am aware that as a member of the academic community, it is my responsibility to turn in all suspected violators of the honor system. I will report to Honor Council hearings if summoned." By attending Old Dominion University you have accepted the responsibility to abide by this code. This is an institutional policy approved by the Board of Visitors. Refer to Student Honor Council
[http://studentservices.odu.edu/hc/]

Withdrawal
A syllabus constitutes a contract between the student and the course instructor. Participation in this course indicates your acceptance of its teaching focus, requirements, and policies. Please review the syllabus and the course requirements as soon as possible. If you believe that the nature of this course does not meet your interests, needs or expectations, if you are not prepared for the amount of work involved or if you anticipate that the class meetings, assignment deadlines or abiding by the course policies will constitute an unacceptable hardship for you-you should drop the class by the drop/add deadline, which is provided in the ODU Schedule of Classes.

Course Disclaimer
Every attempt is made to provide a syllabus that is complete and that provides an accurate overview of the courses. However, circumstances and events may make it necessary for the instructor to modify the syllabus during the semester. This may depend, in part, on the progress, needs, and experiences of the students.

Dr. Alok K. Verma, P.E., CMfgE
Ray Ferrari Professor
Chief Technologist - Lean Institute
Director - MET Program
Engineering Technology Department, KH-214
Old Dominion University
Phone (757) 683-3766
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This syllabus and additional information can be found at the above web site.