Senior Design Manual

GUIDE FOR ECE 4981-6 ELECTRICAL/COMPUTER DESIGN PROJECT

Please read this report cover-to-cover. Grade penalties are likely if you fail to follow these instructions.

Prepared by

M. Shridhar Summer 2004
Revised by J. W. V. Miller Winter 2009
2/1/09 Draft

Department of Electrical and Computer Engineering
University of Michigan-Dearborn
Dearborn, Michigan 48128
Very Important General Guidelines for Successful Design Projects

- Students need to utilize time wisely. This is a serious issue for most of the groups that fail to finish their project in a timely manner. Students have two semesters to complete their projects so there is very little excuse for not finishing. Students should not assume that they could spend little time on their project for the first semester and make up the work in the second semester. Students will be given a letter grade for the work done during the first semester and those who fail to make significant progress during that time should expect a poor grade.

- Students are required to meet with their faculty advisor on a weekly basis. A schedule should be established and followed for this purpose.

- At these meetings, students are to submit a weekly progress report form provided later in this document. The form is to be signed by the advisor and submitted to the ECE 498X coordinator promptly. Some advisers may prefer to sign relevant logbook pages instead. Students must meet at least biweekly with their adviser to avoid a grade penalty.

- Proper planning is very important. Sometimes components, software and other items may have long lead times causing delays. These are issues that must be addressed early on. Have a backup plan for such occurrences.

- If any team member does not participate properly, bring it to the attention of the coordinator immediately. Such issues should be addressed without delay to avoid a grade penalty.

- Some students assume that the scheduled senior design classes are a waste of time but this is a flawed assumption. Students often come out with good ideas and suggestions after they listen to presentations. Also, the coordinator expects first-semester students to attend all scheduled classes.

- **Keep a logbook to document activities and meetings with the faculty advisor.** The coordinator may ask to see the logbook at any time so students should be prepared to show it.

- All reports and proposals should use 1.5 line spacing.

Design Project Specifications/Requirements

Design teams consist of two to four students. Under no conditions may a student work alone. The design project topic is flexible, and each group is encouraged to pick a project that covers the strengths and interest areas of their group members. The design must have the following
components:

• **Microprocessor**

All design projects are required to incorporate either one or more embedded microprocessors or PCs with the possible exception of power projects involving no computer-engineering students and projects with students from other departments.

• **Interface to Something:** Your embedded system must interface to some other device or devices. It could be a computer, or it could be some embedded device such as a Palm Pilot, telephone line, TV, etc. Some interface standards that could be used include serial, parallel, Universal Serial Bus (USB), Firewire, Ethernet, Infrared (IR), Radio Frequency (RF), etc. This requirement has considerable freedom. To assist with some of the more complex interfaces such as Ethernet, USB, or Firewire, there are dedicated chips which encapsulate the lowest layers of the interface. This makes using these interfaces easier to handle but not necessarily trivial. Be sure to investigate the interface(s) you wish to utilize and make a reasonable choice. (NOTE: *Interfaces involving A.C. line current or other projects requiring potentially lethal voltages require special permission from both the course coordinator and adviser.*

• **Ruggedized electronics:** The final implementation of the project should ideally employ custom PC boards or at least one or more soldered breadboard. The use of plastic breadboards is unacceptable.

• **Be of personal interest to the team members:** It is very difficult to devote the time and energy required to successfully complete a major design project in which the team members have no personal interest. There are many possibilities, ranging games to “useful and socially redeeming” items, like audio signal processors and security systems.

• **Be achievable:** You should have a “basic idea” of how to implement your project, and the relative hardware/software complexity involved. For example, you should not design an “internet appliance” if you have no idea how TCP/IP works. Also, plan to use parts that are reasonably priced, have reasonable footprints, and are *readily available*. Be cognizant of the prototyping limitations associated with surface mount components.

• **Be neatly packaged:** The finished project should be packaged in a reasonably neat, physically robust, and safe fashion.
• Not involve a significant amount of physical construction or assembly: The primary objective of the project is to learn more about applying electrical and computer engineering principles to the design of useful devices and systems.

Formal Project Proposal: Each group should submit a proposal outlining their design project idea. This proposal should not be wordy or lengthy. It should include your design objectives, design/functionality overview, and project success criteria. Please follow the template given later in this document.

Project Design Steps: The four elements common to nearly all projects include:

- Create a list of all parts required for your project and obtain them.
- Develop complete, accurate, readable schematic diagrams of the design
- Debug the design and solder the circuit boards
- Package the finished product and demonstrate its functionality

In addition to these criteria, a set of five significant project-specific goals should be specified. The degree to which these success criteria are achieved will constitute one component of your grade. The proposal should also include assignment of each team member to one or more of the goals.

Group Account and Team Web Page: Each project will maintain a team web page that contains datasheets for all components utilized, the schematic, board layout, software listings, interim reports, presentation slides, etc. in password-protected archives. It should also contain scans of the individual lab notebooks and progress reports for each team member. At the end of the second semester, each team must submit a CD-ROM archive of the group account along with the final report and all PowerPoint presentations.

Design Review: Near the end of the first semester, there will be a formal design review. This is a critical part of the design process. In industry, this phase of the design process can often make or break a project. A good design review is one where a design is actively discussed and engineers present concur with the current or amended design.

Design Project Milestones

Each group is responsible for setting and adhering to their own schedule; however, there are
several important milestones, as listed in the table below. Always “expect the unexpected” and provide some buffer in your schedule and budget your time effectively. With proper budgeting, senior design can be a very rewarding and enjoyable experience.

**Writing Requirements**

The Writing Center can assist senior design students in preparing reports. It is strongly recommended that both first- and second-semester students make use of this service. Note that the project advisor can mandate that this be done. Poorly written reports will result in a substantial grade penalty and may well delay course completion. Students should reserve two slots about a week apart so that they can have an initial draft reviewed along with a nearly completed report. Reservations can be made at this link:

http://www.casl.umd.umich.edu/387501/

Students must take a double-spaced draft with them on the initial visit along with reference materials and notes. The first draft should be included in the appendix of the final semester reports. As note previously, poorly written reports will not be accepted nor will the instructor submit a passing grade for the course. Second semester students may want to make an additional appointment with the Writing Center for the final report and allow plenty of time for revisions.

**Second Semester Abstract**

All second-semester students are required to submit an abstract for a college-wide annual compendium in order to receive a passing grade. Please use the template given at this link:

http://www-personal.engin.umich.edu/~jwvm/ece498X/SeniorDesignTemplate.doc

Follow all directions provided exactly. This format is also to be used for the abstract in 498X reports.

**Presentations**

Presentations are a very important part of senior design since they are another aspect of communication. All presentations are to use PowerPoint presentation software with easily readable text and graphics. Avoid the use of bizarre color schemes and flashy animations. Make sure that schematic diagrams have sufficient contrast and thickness. Pspice may be used to create
schematics but editing with a graphics program is needed to enhance them for quality presentations.

**Course Outcomes and Assessment Procedures**

In order to fulfill the course requirements successfully and receive a passing grade, each student is expected to demonstrate the following ABET-mandated outcomes:

**An ability to function on (multidisciplinary) teams: Outcome (d)**

High achievement for outcome (d) would be indicated by

- Routinely present at team meetings or work sessions and contributes a fair share to the project workload
- Is prepared for the group meeting with clearly formulated ideas
- Shares credit for success with others and accountability for team results
- Demonstrates the ability to assume a designated role in the group
- Values alternative perspectives and encourages participation among all team members
- Remains non-judgmental when disagreeing with others/seeks conflict resolution
- Is a courteous and cooperative group member, provides assistance and information
- Has knowledge of technical skills, issues and approaches germane to disciplines outside electrical and/or computer engineering.

**An understanding of professional and ethical responsibility: Outcome (f)**

High achievement for outcome (f) would be indicated by

- Student understands and abides by the IEEE Code of Ethics and the UMD academic Code of Conduct
- Participates in class discussions and exercises on ethics and professionalism
- Demonstrates ethical behavior among peers and faculty
- Takes personal responsibility for his/her actions
- Is punctual, professional, and collegial; attends classes regularly
- Evaluates and judges a situation in practice or as a case study, using facts and applies the professional code of ethics effectively
- Understands the role of professional ethical standards for corporate decisions and is committed to use them effectively.

**An ability to communicate effectively: Outcome (g) (written)**

High achievement for Outcome (g) (written)
• Articulates ideas clearly and concisely
• Organizes written materials in a logical sequence to enhance the reader's comprehension (paragraphs, subheading, etc.)
• Uses graphs, tables, and diagrams to support points and/or explain, interpret, and assess information
• Written work is presented neatly and professionally
• Grammar and spelling are correct
• Figures are all in a proper format
• Uses good professional writing style
• Conforms to the prescribed format if given

An ability to communicate effectively: Outcome (g) (oral)

High achievement for outcome (g) would be indicated by
• Plans and delivers a well-organized oral presentation effectively
• Presentation has enough detail appropriate and technical content for the time constraint and the audience
• Makes eye contact and can be easily heard
• Speaks comfortably with minimal prompts such as note cards and does not read to the audience
• No distracting nervous habits
• Uses proper English grammar
• Uses visual aides effectively
• Has a professional appearance
• Listens carefully to questions and responds to them appropriately

Understanding the impact of engineering in a global societal context: Outcome (h)

High Achievement for Outcome (h) is indicated by
• Is familiar with current trends and developments in electrical and computer engineering
• Respects the historical aspects of engineering solutions and their impacts
• Reads and is familiar with the content of periodicals that are relevant to understanding the global and societal impact of engineering
• Has a personal perspective on the importance of engineering and technology in
today's world

**An ability to engage in lifelong learning: Outcome (i)**

High Achievement for outcome (i) would be indicated by

- Demonstrates ability to learn independently and goes beyond basic requirements in completing an assignment.
- Learns from mistakes and practices continuous improvement
- Demonstrates capability to think for one's self and actively pursues learning opportunities
- Is able to understand, interpret, and apply learned materials to practical problems.
- Participates and takes a leadership role in professional and technical societies

**Knowledge of contemporary issues: Outcome (j)**

High Achievement for outcome (j) is indicated by

- Has knowledge of current events in the engineering discipline and in society
- Has a good perspective on the current job market
- Able to discuss in-depth technical aspects of major political issues at the national, state and local levels
- Can summarize essence of important technical issues and take and defend a position on them
- Is able to evaluate technical solutions, or scenarios using a series of different measures including economic, environmental and political ramifications

Grading: The following table describes how grading will be accomplished.

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Proposal 25%</th>
<th>Nontech. 20%</th>
<th>Oral Pres. 15%</th>
<th>Progress Rep. 10%</th>
<th>Adviser Eval. 30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second Semester</td>
<td>Oral Pres. 20%</td>
<td>Final Pres 20%</td>
<td>Final Report 20%</td>
<td>Progress Rep. 10%</td>
<td>Adviser Eval. 30%</td>
</tr>
</tbody>
</table>

90 and above is an A, 80-89 is a B, 70-79 is a C, 60-69 is a D, 59 or less is an E.

*******************************************************************************

**The proposal template begins on the next page**

*******************************************************************************
NAME:  
DATE: 

TITLE: Select a title that describes your design project 

ADVISOR: Give the name of the faculty advisor. 

DESCRIBE BRIEFLY AIMS AND GOALS OF THE PROJECT: 
Give a clear description of what this design project is intended to accomplish.

Why is this project important or useful or interesting? It is important to list potential applications or enhancements to existing applications. Or you have found a more economical way of designing some product that makes this design experience worthwhile.

DESCRIBE RELEVANT PRIOR WORK: 
You may have access to reports, textbooks or some other references on the project you are proposing. A professor may have suggested this project or the company you are working for wants this project carried out. In any case you should be able to find some relevant literature on the subject. List them at the end of the proposal. Here you provide a concise description of existing work in the area of your design project. Also list the ECE courses that have given you the background to tackle this work. If you undertake a project involving wireless communications and no one in your group has taken ECE 450 or ECE 471, the project may not be approved. The same goes for other topic areas like control systems, computer networks or computer hardware. In other words, the group collectively must have appropriate background (through proper course work) in the topic area of the project.

PRELIMINARY IDEAS AND METHODS:
There are only about 24 weeks to finish this project. Hence it is important that you have a clear idea of what needs to be designed, what design techniques you plan on using etc. If you are a team, then you should think about who is doing what and in what fashion. REMEMBER that each member of the team must be involved in the design process. You cannot say that X did the design, Y did the implementation and Z did the testing. That is simply not acceptable.

What is expected is something like X will design, build and test subsystem 1, Y will do the same for subsystem 2 and so on. Finally the team will come together in integrating the different subsystems to create the final system, which must then be tested for proper performance. This subsection is the heart of your proposal. Put your best effort here. Design necessarily involves...
making choices, using appropriate performance criteria to guide the design process. Performance criteria include cost, complexity, speed, accuracy etc.

**COST ANALYSIS:** This is important because components, software packages, development packages and other items can be very expensive. The department or college may fund an acquisition if it determines that there is some long-term benefit. Otherwise, the students will need to provide the funds.

**TIME SCHEDULE:** As stated earlier, you have about 24 weeks. Efficient utilization of available time is very crucial to the success of your design effort. Please provide a time schedule using a Gant chart or similar planning tool for completing the various phases of the project.

______________________________________________________________________

SIGNATURES: STUDENT \hspace{1cm} ADVISOR \hspace{1cm} COORDINATOR

NOTE: THE PROPOSAL SHOULD BE ABOUT 1000 WORDS LONG. THIS GUIDE HAS 476 WORDS
ORAL PRESENTATIONS

Each project team will make at least four presentations (not counting the final presentation) over the duration of the project (two semesters). These will consist of

- Presentation of project proposal (semester 1)
- Presentation of final proposal and progress report (semester 1)
- Detailed progress report (semester 2)
- Practice final presentation (semester 2)

Note: Each member of the team must participate meaningfully in these presentations

********************************************
Progress Report Forms Follow Next
********************************************
ECE 498X ELECTRICAL/COMPUTER ENGINEERING DESIGN
INDIVIDUAL PROGRESS MONITOR

____________ Term 20__

DATE:
NAME:
TITLE:
ADVISOR:

DESCRIBE BRIEFLY YOUR PROGRESS TOWARD THE PROJECT:

DESCRIBE PROBLEMS/DIFFICULTIES ENCOUNTERED:

COMMENTS AND SUGGESTIONS FROM ADVISOR :

________________________________________________
Student signature and date

_______________________________________________           ____________________________
Advisor signature and date                        Date submitted to coordinator
DATE:
NAME:
TITLE:
ADVISOR:

DESCRIBE BRIEFLY OVERALL PROGRESS TOWARD THE PROJECT:

DESCRIBE PROBLEMS/DIFFICULTIES ENCOUNTERED:

COMMENTS AND SUGGESTIONS FROM ADVISOR :

_____________________________________________           ____________________________
Student signatures                                    Date submitted to coordinator

________________________________________________________
Advisor signature and date                             Date submitted to coordinator
Project report template Starts on the next page
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ACKNOWLEDGEMENTS \hspace{0.5cm} XXII  
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3. TASKS ASSIGNED TO EACH MEMBER.  
4. DESIGN CHOICES AND PERFORMANCE CRITERIA  
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ABSTRACT

This section must be included in your report. Please use the format given at this link and follow directions exactly:

http://www-personal.engin.umich.edu/~jwvm/ece498X/OradyAbstractTemplate-1.doc
Acknowledgements
During your participation in the design project, you may have received help from individuals, institutions and industry representatives. A company may have donated software or a product to further your design. Fellow students may have helped you with useful suggestions and recommendations. You also probably received help from ECE shop, from faculty members and from ECE staff. It is imperative that you formally acknowledge all the help you received.
1. INTRODUCTION

This section must be included in your report

Please provide a one-page introduction to the topic area providing background information, its significance and important applications. Then provide justification for the project you have selected.
2. PROBLEM STATEMENT

   This section must be included in your report

(1 page)

2.1 General design approach
In this section, discuss different approaches to solve design problem and describe the criteria (technical performance, size constraints, power limitations, cost etc.) used to select a specific design method. State clearly the reasons that lead to a specific design approach.

Each student in the team should contribute to this section by describing his/her design task, the criteria to be used for making design choices and design methodologies. In this section clearly define the problem to be solved, together with performance specifications and overall objectives.

2.2 Tasks assigned to each member

Enumerate tasks for each student:

The tasks for Sam Smith are as follows:

1. Evaluate gizmos and make a recommendation
2. Design a gizmo for the framus
3. Design a gizmo for the skyhook

The tasks for Tom Jones are as follows:

1. Evaluate warp drives for interstellar travel
2. Design the dilithium crystal storage unit.
3. ……

The tasks for ……

IMPORTANT:

- Your group must consider realistic constraints such as size, weight, current, voltage, bandwidth, power, cost etc.
- You must realize that the design project is essentially open-ended in the sense that certain features may not be achievable and you need to compromise.
4. Design choices and performance criteria
In this section, discuss different approaches to solve design problem and describe the criteria (technical performance, size constraints, power limitations, cost etc.) used to select a specific design method. State clearly the reasons that lead to a specific design approach.

Each student in the team should contribute to this section by describing his/her design task, the criteria to be used for making design choices and design methodologies.

5. Details of the design
This section is the most important part of the document

Present complete details of your design, including block diagrams, flow charts, circuit diagrams layout and whatever else is relevant. (Not to exceed 5 pages of text)

5.1 Design Tasks for each member
Each student in the design team must clearly describe the specific design effort undertaken to meet the objectives of the project. (About two pages for each team member)

5.2 Final System
A number of questions need to be answered in this section. How do you go from your prototype design to the final product that can be marketed? Are there fabrication issues? Can VLSI techniques or similar mass production methodologies be used. It should be noted that packaging is a very important issue in product/system development. Packaging is important for both safety and cosmetic reasons. The product must appeal to the potential buyer and it must withstand normal day-to-day use. If your project involves software development, how will you go about getting the final version for eventual use by your customers? Are there guidelines or standards for development of software to meet customer requirements and expectations? (2 pages)

6. Test results and conclusions
Describe in detail the test results and your interpretation of the results in as far as how well you accomplished your design tasks (2 - 3 pages)
7. Nontechnical aspects of design

Provide a one-paragraph introduction summarizing the contents of section 7. Here, you present cost analysis, product pricing, economic benefits and other nontechnical issues. (1 page)

7.1 Detailed Cost Analysis
   This section must be included in your report

7.2 Economic Benefits, Societal Impact and Global Issues
   This section must be included in your report

7.3 Safety and ethical issues (1 page/member)

In this section, you discuss safety issues and the consequences of failure of your system or the failure of any component in your system. Also present strategies to maximize safety of your system. (1 page)

7.4 Lifelong Learning (1 page/member)

In this section, explain in your own words, why you think lifelong education is essential for an engineer to stay current as the technology evolves. Describe your position by visualizing where you will be professionally over the next three, five and ten years.

Please note that your interests may change from technical work to managerial responsibilities; however, you would be required to learn new skills associated with your current responsibility.

Other factors that would influence the need for lifelong education include, globalization of technology and the workforce, availability of highly trained engineers from countries with low wages (we call it outsourcing). However, the most important consideration will continue to be the rapid evolution of new technologies.

7.5 Contemporary Issues (1 page/member)

Describe in your own words, what are the current issues that affect our society. These may include new disciplines such as biotechnology, nanotechnology, artificial intelligence and robotics, spread of AIDS, high cost of medical care. However, these issues can be affected by emerging technologies.
8 Conclusions and Executive Summaries

This section must be included in your report

Present in bullet format, salient and relevant conclusions drawn from your design experience. Even conclusions that are not favorable should nevertheless be included. In addition, provide a one-page executive summary from each member.
9. REFERENCES

This section must be included in your report
10. APPENDICES: All derivations, intermediate results, detailed circuit diagrams, details of apparatus used, computer programs, photographs etc., that are not immediately relevant to the project should appear under appropriately numbered Appendices.

The design team must include the original proposal, modifications to the proposal (if any), progress reports, all report drafts submitted to advisor or the Writing Center and the executive summaries of each participating student. The final report will not be accepted, if this appendix is missing.

Vita Auctoris: A one page description of each student, his/her educational background, awards, trophies, hobbies and research interests should appear at the end as an Appendix.

All reports must be prepared on a word processor. The initial draft report should be printed one side only and double-spaced on 8 1/2 by 11 sheets. The final report should be printed singled sided with a 1-1/2 line spacing. Preferred font is “Times” size 12.
One of the ABET requirements for a good design course is familiarity with costing. Each student is required to participate in this effort. When you calculate cost, you must include the following:

1) Cost of components
2) Cost of your time. (Assume that you are worth $50/hour)
3) Facilities rental (When you use lab facilities at the University or elsewhere, you are incurring cost - cost of depreciation, maintenance etc. What are reasonable costs?)
4) Use of lab space - rental cost: What is reasonable?
5) Cost of fringe benefits - 30% of your wages
6) You must also add your course instructor's cost on a fractional basis. Thus if the class has 10 students and if one course equals one month salary, you should divide this figure by 10 to arrive at advising cost. You may assume faculty advisor cost at $100/hour (very inexpensive) for 5 hours/week.

There is one other issue that must be considered: pricing of a product. How does one price a product? Several factors must be considered:

1) Are similar products available in the market? If so, the price should be comparable to prices of similar products.
2) If the product is new to the market, then the price will be dictated by development cost and return on investment but must be reasonable for the benefit delivered. Customers are not likely to spend $1000 for a radio or $20,000 for a PC computer.

Let us say that the development cost of a product is 15,000 dollars. Let us also assume that you expect to sell 500 items in the first year and about 700 in the second year. You should try to recover your development cost in the first two years plus a reasonable return on your investment. Since projected sales is about 1200 items over 24 months, recovery cost is 15,000/1200 = $13 approx. Add to this your profit margin which could be about $13. The cost to the buyer will then be at least $26. Add to this agent commission, advertisement costs, complimentary gifts etc. Your cost would be around $30- $35/item. This approach is not accurate but it does provide a ballpark figure. In any case, the cost of the product should always be substantially higher than the cost of the components, labor indirect costs, etc.
The next phase for you to consider is socio-economic factors. What is the impact of your design effort? Who does it benefit? Who will lose out? Will your product degrade the environment by emitting chemicals, noise etc. Will your product have any risks (safety, catastrophic failure etc.). Recently a software glitch in AT & T's telephone network caused a blackout of New York for several hours. This type of software failure can have serious consequences both economically and in terms of providing essential and critical services. There were also reports of a software controlled radiation unit that caused patients to be exposed to dangerous levels of x-rays. The above examples clearly indicate the need to be aware of safety issues in any development effort, whether it involves software or hardware.

Every project will have some form of impact on the environment. The term "environment" is used in a very broad sense.
b. **APPENDIX 2: ONE PAGE VITA**

**THE UNIVERSITY OF MICHIGAN-DEARBORN**

Department of Electrical & Computer Engineering

1. **Name and Academic Rank:** MALAYAPPAN SHRIDHAR, Professor

2. **Degrees, with fields, institutions and dates:**

   - B.Sc. 1959 University of Bombay (Math & Physics)
   - D.MIT. 1962 Madras Institute of Technology (Control Systems)
   - M.S. 1967 Polytechnic Inst. of New York (EE)
   - Ph.D. 1969 University of Aston in Birmingham, U. K. (EE)

3. **Number of years of service on this faculty:** 10 years

4. **Other related experience - teaching, industrial, etc.:**

   - 1969 -1985 Faculty Member, EE Dept., University of Windsor, Windsor, Ontario.
   - 1963 -1966 Scientific Officer, Bhabha Atomic Research Center, Bombay, India.

5. **Consulting:**

   - General Cable Co., New Jersey
   - Diffracto Ltd., Canada
   - General Motors Co., USA
   - CGA-Alcatel, France
   - Ford Motor Co., USA

6. **States in which registered Professional Engineer, Province of Ontario.**

7. **Grants and Research Contracts:** NSF-ILI (94-96), USPS (94)

8. **Journal and Conference Publications in 1994-95**

   1. Yi Lu and M. Shridhar, “Character Segmentation in Handwritten Words”, Accepted by J. of Pattern Recognition, 1995
PREPARATION OF DETAILED PROGRESS REPORT AT THE END OF FIRST TERM

Please follow the instructions carefully to avoid grade penalties.

The detailed progress report should consist of the following information organized properly:

- **Original Proposal**
- **Revisions** made to the original proposal during the term with reasons for the change and detailed description of the changes
- **Problem Statement** – here you get technical and essentially translate goals into specific problems and associated tasks including quantitative specifications, performance criteria etc. You must consider realistic constraints including cost, size, power, performance safety, societal impact etc. Design alternatives must definitely be considered and the criteria used to select a specific design must be stated clearly. **This is an important requirement.**
- **Task Assignment** – here you divide up the work among your team members. You must ensure that each team member takes responsibility for a specific design task (ABET mandated)
- **Progress Made** – This is a **critical part of your progress report**. You must describe the work done, equipment, components and software acquired or developed tests conducted and current state of the project.
- **Tasks Remaining** – Describe work that remains to be done during the second term and include a time line for finishing up the project.
- **References** – Include a set of references cited in your report.

The report should be about 15-20 pages with line spacing of 1.5 and a font size of 12. Include additional materials in appropriately labeled appendices.
<table>
<thead>
<tr>
<th>Slide Number</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The first slide must give a brief description of the project and some of its key features. List in bullet style, some of your achievements and also include some limitations.</td>
</tr>
<tr>
<td>2</td>
<td>The second poster must define the problem technically and list all the design requirements (typically your wish list).</td>
</tr>
<tr>
<td>3</td>
<td>Translate requirements into technical specifications (weight, height, power, bandwidth, accuracy, speed etc.).</td>
</tr>
<tr>
<td>4</td>
<td>Identify the subsystems that must be designed. Describe these clearly. Also assign to each team member responsibility for some critical aspect of design.</td>
</tr>
<tr>
<td>5</td>
<td>List Design Criteria (Minimum error, minimum cost, highest accuracy, minimum time, low power, high bandwidth etc.) List also constraints like cost, size, time, availability of resources etc.</td>
</tr>
<tr>
<td>6</td>
<td>Present different design options and choose one option based on design criteria and constraints.</td>
</tr>
<tr>
<td>7</td>
<td>Present design details. This could include design of filters, amplifiers, software, digital hardware etc.</td>
</tr>
<tr>
<td>8</td>
<td>Include test results for each subsystem. Describe overall test results and performance. Compare performance with specifications and list those specifications met and those not met.</td>
</tr>
<tr>
<td>9</td>
<td>Present a crisp set of conclusions Include some ideas for future work.</td>
</tr>
<tr>
<td>10</td>
<td>Include acknowledgements. You must acknowledge help received from companies, different faculty, fellow students and shop technologists.</td>
</tr>
<tr>
<td>11</td>
<td>Include some pictures and graphics that will highlight your project.</td>
</tr>
<tr>
<td>12</td>
<td>Include more pictures and graphics that will highlight your project.</td>
</tr>
</tbody>
</table>
Submit draft report directly to your faculty advisor on the day of your poster presentation.

1. After you receive the corrected report from your advisor (within 2-3 days), collect all progress reports from the project coordinator (Shridhar).

2. Make the appropriate corrections to your report. Collect front and back covers from the ECE office. The front cover should list the title of the project in bold (font size 24) at the top, followed by the UMD block-M logo. Below the logo enter the names of your group members in alphabetical order (one name per line). Below the group names, enter the semester and year (Winter 2010 for example). At the bottom, list the following in bold with a font size of 12:

   **Procedure for submitting the final design project report**

   Joe Peterson
   Alicia McPherson
   Sameer Beydoun

   Winter 2010

   Department of Electrical and Computer Engineering
   University of Michigan-Dearborn
   Dearborn, Michigan 48128
   Tel: 313-593-5420 Fax: 313-593-9967

3. Collect the proposal, the detailed progress report (submitted at the end of semester 1) and the weekly progress reports you collected from the Project Coordinator. Insert these as appendices with appropriate headings.

4. Take the compiled final report (together with front and back covers and all appendices) to the copy center (or Kinko’s) and get it spiral-bound.

5. Submit at least one copy to the department (it will not be returned), along with the draft report, which was corrected by your faculty advisor.

NOTE: There will be a grade penalty, if you don’t follow the above instructions. Also your final grade will be released only if you have successfully passed the ethics part of the course offered by Prof. Ostrum (or an alternate)