

ME 113 (16-17)

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ME113 – Mechanical Engineering Design

SCHEDULE

Classes T,Th 1:30–4:20 pm*
 Coaching Sessions T,Th Assigned times/locations between 1:30–4:20 or other times/days to be determined.
***PLEASE BE SURE TO RESERVE THE ENTIRETY OF THESE TIME PERIODS FOR USE BY 113 FOR CLASS MEETINGS**

WK	Tuesday	Thursday	Other
1	4/4 (<i>Meet as class</i>) Introduction Course Objectives Project Descriptions	4/6 (<i>Meet as class</i>) PROJECT PREFERENCES DUE IN CLASS Sponsor Interaction Coach's Function Information Gathering	
2	4/11 (<i>Meet as class</i>) Scheduling Information for Coaching Sessions Project Design process & Group Dynamics	4/13 Coaching Sessions	4/17 DESIGN PROPOSAL (1 PDF AND 2 HARD COPIES) DUE 4:00 PM, MONDAY, 4/17, BUILDING 550-132
3	4/18 Coaching Sessions	4/20 Coaching Sessions	4/24
4	4/25 Coaching Sessions	4/27 Coaching Sessions	
5	5/2 (<i>Meet as class</i>) MIDCOURSE DESIGN REVIEW PRESENTATIONS, 1:30 TO 4:20 PM	5/4 Coaching Sessions	5/8 MIDWAY REPORT (1 PDF AND 2 HARD COPIES) DUE 4:00 PM, MONDAY, 5/8, BUILDING 550-132
6	5/9 Coaching Sessions	5/11 Coaching Sessions	5/15
7	5/16 Coaching Sessions	5/18 Coaching Sessions	
8	5/23 Coaching Sessions	5/25 Coaching Sessions	
9	5/30 Coaching Sessions	6/1 Coaching Sessions	
10	6/6 Coaching Sessions	6/8(<i>Meet as class</i>) FINAL PRESENTATIONS, 1:30 TO 4:20 (LOCATION TO BE ANNOUNCED LATER)	6/12 FINAL REPORT (1 PDF AND 2 HARD COPIES) AND DESIGN NOTEBOOKS DUE 9:00 AM, MONDAY, 6/12, BUILDING 550-132

Course Website:

<http://web.stanford.edu/class/me113/>

ME113 – Mechanical Engineering Design

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Details on the items below are provided in the pages that follow.

	<i>Description</i>	<i>% of final grade</i>
1)	Design Proposal	8%
2)	Design Notebook	5%
3)	Reports	
	Midway	18%
	Final	32%
4)	Midway Presentation	12%
	Final Presentation	18%
5)	Coach's Evaluation	7%
		<hr/>
	TOTAL	100%

1. Design Proposal (1 pdf and 2 hard copies for review by teaching team and ABET)

The proposal is one of the more important documents that an engineer may be called upon to prepare, whether working in industry, government, academia or consulting.

The proposal is written to a specific person (e.g., a client) or small group (e.g., a board of directors or a review committee) with a technical or design challenge that you believe you can address. In some respects, it is a “sales document” to persuade that person or group that you:

1. clearly understand what the challenge is; including the scope of the challenge,
2. have studied the background, previously attempted solutions and related literature (including patents as relevant),
3. have ideas about how the challenge may be addressed,
4. can suggest ways to evaluate the pros and cons of these ideas, and
5. have a plan to achieve results within a budget and time available (a time-table of tasks is often useful)

The proposal should be professional. Statements must be supported with evidence. Ideas must be defined clearly and with enough detail and illustrations to enable readers to evaluate them readily. Drawings should be done with care.

A typical template for a proposal is:

1. A Title Page showing, in addition to the project title, the name(s) and contact information of those preparing the proposal.
 2. An Introduction that summarizes the background and considerations that led to the project.
 3. A statement of Objectives, which should be stated as precisely as possible. In this class, it will usually contain the overall project goals plus design or technical criteria that your project will strive to meet.
 4. A section on the Proposed Approach(es). This section summarizes how you expect to proceed. It often includes a discussion of past approaches (e.g., from searching, from project partner) and their advantages and drawbacks. Describe several of your potential design approaches (as appropriate to the nature of a project). Summarize which approach(es) will be used to select the most promising one for further development without actually doing the evaluation in the proposal. Carefully prepared, clear illustrations of ideas are appropriate in this section.
 5. A Time Management Plan. This includes a prospective time-table with milestones (e.g., preliminary design, final design completed, testing initiated, testing completed, prototype construction initiated, etc.).
- A. Appendix: This may include any calculations, technical data and other supporting information for the main body of the proposal.

In proposals, there are often other items, such as qualifications of the proposer(s), budget, and various contractual conditions. Those are not needed in your proposal for ME 113.

Reports should be *double-spaced* and on **one side** of 8½ x 11 in. standard pages.

Please staple or bind the proposal together.

2. Design Notebook

In any design project, the final drawings, models or prototypes are only a part of the value of the design. Part of the value also resides in the process used to generate it. As a simple example, suppose you designed a product normally made of aluminum and your final design called for plastic instead. It would be useful to describe why. One reason might merely be that the price of aluminum had become too high in recent years. This is useful information and adds to the value of the design documentation, because someone will now be in a position to consider a switch to aluminum if, for example, there is a rise in the price of plastics.

The purpose of the design notebook is to document your design process. Taking the time to record concepts, information, etc. while fresh in your mind is typically more efficient than trying to reconstruct them from memory when preparing reports and presentations.

The design notebook includes:

- preliminary sketches, outlines and plans for different aspects of the design
- notes resulting from information searching and any discussions you may have had with experts, as well as notes on results from group meetings
- summaries of conversations with vendors, copies of vendor data, etc.
- the choices you made at each step: what you chose, what you rejected, and a record of the calculations you performed
- results from any tests you conducted

One notebook per person

Grading of notebooks will be: **+** (better than average), **OK** (average), **-** (marginal). The notebook is *not* expected to be a polished, edited document (that's what the reports are for) but we should be able to review it and tell what you did and why. Incidentally, over several years, we've found a correlation between good notebooks, good designs and good project results.

The design notebooks will be handed in at the end of the course. Please see the schedule.

3. Reports

As with design notebooks, the reports are cumulative. In other words, the final report that you submit may make use of material (possibly revised) submitted earlier in the course. Also, as with the notebooks, the reports document your design and the process used to generate it.

To assist your preparation of reports, samples of well-prepared reports from previous classes will be distributed approximately ten days prior to the due date for your report.

3A. Midway Report (1 pdf and 2 hard copies)

The report should contain revised material from the design proposal, including:

- a more definitive version of the design criteria, if needed
- project summary, including motivation for the project and its objectives
- updated timetable showing current status.

In addition, the midway report should contain, as relevant:

- **High quality illustrations** (please, no hastily drawn rough sketches) and descriptions for several alternate design concepts as further developed since the design proposal.
- Summary of information used in helping to evaluate concepts. This should extend what is in the design proposal with additional information obtained.
- Any calculations (and other methods as appropriate) used in evaluating design concepts

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- Results of any preliminary working model and proof-of-concept tests used to evaluate design approaches
- Description of the design concept that will be pursued to a working model or prototype and the rationale for its selection from the concepts evaluated
- Material selection, manufacturing considerations, human factors, etc. that may need to be addressed
- Plans for further development of the design concept, including testing plans as appropriate

3B. Final Report (1 pdf and 2 hard copies)

Your final report should stand on its own. Someone unfamiliar with your project should be able to read your final report and get a good sense of what your design challenge was, and the approach you are proposing. The final report should contain revised material from the proposal and midway report plus:

- detailed part drawings of the design concept pursued
- layout drawings — annotated so that a first-time reader can understand them
- description and results of tests conducted for your design (if applicable)
- explanation and justification of materials
- design for manufacturability considerations
- fabrication and assembly instructions or drawings
- maintenance, repair, and other considerations, as relevant

Format for Midway and Final Reports

Reports should be *double-spaced*, except as noted, **one-sided** of 8½ x 11 in. standard pages.

Engineering drawings and photos are strongly encouraged.

Please staple or bind the reports in a report folder.

Format

- Title page with project title, team name, names of team members, and date.
- A separate page containing an abstract of the project, emphasizing the objectives, design requirements, approach taken, and results of the project to date. This can be single-spaced.
- Table of contents (separate page)
- Introduction
- Main Body of Report
 - functional description of the *main features* of the design or approach pursued
 - *summary* of approach taken to arrive at a design (analysis, testing, model building, etc.)
 - discussion of factors pertinent to your design (aesthetics, manufacturing, cost, safety, reliability, etc.)
- Discussions of detailed subsystems and summary of possible alternatives considered.
- Summarize results and conclusions from calculations or testing (Details should go in Appendices.) Refer to detailed drawings.
- Updated project timetable
- Appendices---Calculations, testing notes, data supplied by vendors, etc.

Engineering drawings and sketches:

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High quality engineering sketches and drawings are expected. These should be prepared to scale, using CAD or manually. For the design proposal, there is no need for formal engineering drawings, but by the time of the midway report, projects should hopefully be to the point where scaled, detailed engineering drawings are needed to proceed with analysis, build prototypes, etc. Layouts to scale are particularly useful at this stage to see how everything should fit together and function as intended.

4. Presentations

4A. Midway Presentation

5/2 Presentation Session 1:30 to 4:20 (classroom)

This is an oral update on your project. Attendees will include your fellow classmates. **Your team will have 10 minutes to present your progress, plus 5 minutes for questions and answers**, so please rehearse to make sure that you stay within that limit. The majority of your time should be spent in summarizing your project and its goals, discussing your approach(es) and your work plan for the rest of the quarter. You should include a few words on major obstacles you may foresee. Slides and physical models (as applicable) should be used to communicate your progress to date. Videos may also be used, if appropriate.

4B. Final Presentation at EXPE

6/8 1:30 to 4:30 Location and presentation details to be announced later in the quarter

Congratulations! You've been working on your project for two months now and you're ready to show your results.

The entire class will gather at the same time. Each team will have an opportunity to exhibit project results using visual media and project hardware. Some considerations to keep in mind for both the midway and final presentations are:

Is the concept fundamentally sound? Will the design really work and will people want to use it?

Is the design properly engineered? Have you done relevant analyses and/or tests to be sure that it meets the design criteria and performs to the functional specifications?

Is the design producible? Approximately how much would it cost to manufacture? Are the parts readily available or do some have to be custom-manufactured?

5. Coach's Evaluation

This part of your grade is based on feedback from coaches and project partner.

Each team will meet once a week with one or more coaches who will act as a sounding boards and provide advice on the design. **However, final design authority and the responsibility for the success of the project ultimately rests with your team.**

You will also likely have regular meetings in person or by telecommunication with the project partner, in most cases, the person who proposed the project. Hopefully, he or she will be pleased with the project results.

At the end of the quarter, the coaches as well as project partners will be asked for comments on a team's efforts and the project outcome.

Your Team, Project Partner and Coach

What your project partner and coach can do for your team:

Sometimes a group of designers can become so comfortable with a particular design approach that they fail to realistically assess its pitfalls, or they reject other potentially successful design approaches. You may think that a particular approach is too far-fetched, or too far out of your “comfort zone,” to pursue. Your coach and project partner may be able to help you to assess the difficulty of a given approach or locate resources outside your area of expertise. Their collective experiences may also help you to identify potential problems with a design approach before these problems manifest themselves in the form of hardware (as they so often do!). Whether reviewing a design concept, assisting with design analysis, etc., your coach and project partner can provide an invaluable “second set of eyes” on your project. Remember that your project partner and coach are interested in helping you succeed, so please take any review comments from them in that spirit.

What your coach can do for your team:

Provide Planning and Scheduling Advice: Since your coach has experience with this class, the difficulties of a rather short design cycle are probably familiar to him or her. Your coach has a good idea of where you need to be during the quarter to successfully complete your project. While your coach won't be able to schedule your project for you, he or she can provide a good reality check on the time that you're allowing to complete tasks. Additionally, your coach should be able to help you define the scope of your project so that it can be completed on time.

Provide a Link to Your Sponsor: You'll be dealing with your project partner directly, but please let your coach know if a problem develops in dealing with the project partner. Your coach may be able to help resolve the problem. In some cases, your coach may be acquainted with the project partner, but in many other cases, may not.

Provide “Group Therapy:” Some teams encounter problems with group dynamics. Coaches are called upon to intervene in the event of a group-related problem. Your coach may work with you to resolve a personality or ego clash, to help set team priorities, or to help divide up the project work load.

Please note that your coach is not supposed to function as a repository of technical information relevant to your project. Part of the course experience is for your team to seek and gather needed information.

Meeting with your coach and project partner:

Weekly team meetings will be held with your coaches. It is also recommended that you communicate with your project partner on a regular basis (perhaps weekly) either through meetings at the project partner's organization if the project is local, or by telecommunication (phone/ email/ teleconference/ web conference) if the project partner is out-of-the-area. It is a responsibility of your team to arrange for such meetings/ communications with project partners. As you get further into your project, you may find that your project partner is quite familiar with what you are doing, and a weekly update may be unnecessary. In that case, make sure to keep the project partner informed of your progress and ask how often he or she would like to meet or communicate with you. Make sure, however, to meet with your on-campus coaches as scheduled.

9. Project Expenses and Reimbursement

Project budgets will be determined in conjunction with the teaching team-Remember to track your project expenses, and save all of your receipts! Turn in these receipts via the regular reimbursement procedure that will be provided.

