

MEEG 101 Design Lab Assignments

This Document contains all of the Laboratory Assignments that you will be working on this semester. The assignments are numbered L1 to L7. Several of these assignments have more than one part and are labeled using the suffixes a, b, c, etc. to designate the first, second, third, etc. part. You must consult your Course Calendar to find out when these various assignments are made and when they are due.

Assignment L1 (Teammate Interview)

The objectives for this assignment are (1) to help you to become more familiar with your teammates, (2) to introduce you to the presentation of technical work, and (3) to introduce you to the assessment process that will be used throughout this course.

As a team, decide who will interview whom. Every member of the team must (1) conduct an interview and (2) be interviewed by another member of the team.

Following the Team Interview Checklist, interview your team member and write up a short biography that will be included in your Team's Design Notebook. Include in your biography: the person's name, where they were born, how many years they've been at UD, where they live, whether or not they work, why they chose engineering, what their major is and why they chose it, any hobbies they might have, what their personal goals are for MEEG 101, and some unique trait they can bring to the team. You may include any other items that you or your team might find interesting as well.

You must present your work up to expectations (i.e., use the Presentation Sandwich that is discussed in Part I of Section J of the Orange Workbook and further defined by Presentation of Technical Work Checklist).

Assignment L2 (Preparing Design Notebook)

All the work that your team does in lab is to be collected, organized and presented in a team Design Notebook. This is the first assessment of your notebook and uses the Zeroth Assessment Checklist. You should go over each item in this checklist and ask yourself: "Have we done this?" You can see from the checklist that the important items concern the organization of the notebook. This Notebook will be organized according to the material found in Part II of Section J of the Orange Workbook and all the work is expected to meet the course's presentation of technical work expectations.

Assignment L3 (Project 1)

This is the first of the two projects undertaken in Laboratory. This project allows you to practice a number of techniques and skills involved in problem solving. This project is more structured and controlled than the second project, having a number of required work assignments associated with the project. There are many types of projects that could be assigned to allow your team to learn and demonstrate the course techniques but the course instructors have selected this project for two major reasons. First, this project lets you design a product; you get a chance to practice real engineering decision-making.

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Second, this project lets you design a process (the manufacturing assembly plan); process design is one of the major things engineers do.

L3a - Problem Definition

The director of sales and marketing at your toy manufacturing company has asked your engineering design team to begin designing a mechanical water-balloon launcher that can safely be enjoyed by 3rd graders. The objective is to toss a softball-size water balloon to another child 20 meters away. Repeatability is important. Other factors that should be considered in the design are cost (you will be buying the materials), safety (you must consider small fingers, and you may not use gasoline or chemical reactions), and ease of manufacturing (another team will be assembling your device). The director of engineering will be updated weekly on the status of this project. By next week your design team should gather all pertinent information, decide what criteria are important for a successful design, and clearly define the problem at hand. Remember, it is important to understand, as a team, what the real problem is. You are expected to perform the Duncker Diagram technique, Present State / Desired State task, as well as a Statement-Restatement exploration of the problem. Evidence of understanding the customers, their wants, and metrics needed to define the engineering specifications will be documented using the UDesign spreadsheets.

L3b – Benchmarking and Idea Generation

Now that you have defined the problem (#L3a), your team must generate multiple solutions in a brainstorming session. Use benchmarking to discover existing systems or functional solutions relevant to the problem to use as starting points for your brainstorming. Explicit evidence in the work product of doing Brainstorming, enhanced by the use of Osborn's Checklist (vertical thinking) and Random Stimulation (lateral thinking) is expected.

L3c – Concept Selection

The actual project implementation is covered in the next assignment (#L3d); this assignment addresses some planning that you should be doing to ensure that the final phases of this entire project will be successful. Brainstorm a set of tasks, problems, projects, etc. that must be undertaken between now and the day the project is to be completed. Your team is to do a Kepner-Tregoe Situation Analysis (KTSA) for your team's current situation. The tasks you brainstormed are the rows in your KTSA Table. Each team should have at least five such tasks. Once you have completed this KTSA Table, review it to prioritize the order in which these tasks will be undertaken by the team.

Your team must also use UDesign to evaluate the top alternative solutions you generated in L3b against the criteria you defined in L3a. Based on the analysis of the UDesign spreadsheets, your team will implement the best solution in the next two weeks.

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L3d - Implementation / Potential Problem Analysis

Now that your team has decided on the best type of water balloon launcher, it is time to start implementing the solution by creating design sketches, deciding on the proper materials and dimensions, and thinking about construction of the device.

After coming up with your initial design idea, you are to develop and use a Kepner-Tregoe Potential Problem Analysis Table (KTPPA). Look at the parts you have to assemble and the process needed to assemble the parts and then analyze the process using KTPPA. It is expected that this analysis will lead to revisions or modifications of the actual design.

L3e - Manufacturing / Process Design

As pointed out in the previous assignment, you still need to design a process for constructing or manufacturing your product. Your task is to create the assembly plan to be used by another student team. It is expected that the final assembly plan will:

- a) consist of a good integrated mixture of drawings, figures, and text,
- b) show explicit evidence of the improvements stemming from the KTPPA analysis done in Assignment #L3d, and
- c) be understandable for someone who has never seen the device before.

Once the other team has assembled the product, we will go outside to test the product.

Assignment L4 (Team Process Checks)

Learning how to stop and review what you are doing rather than blindly continuing down the path you have selected is one of the hardest things to do, especially when the path is leading in a good direction. But successful, creative people and teams stop periodically and evaluate their plans to help improve what they are doing. There are a number of different ways to start doing this reflective pausing; you are going to use a Team Process Check and Peer Evaluation in this class. The material on productive meetings discusses the need to evaluate the meeting process. The material on Team Norms discusses the need to use Constructive Feedback (a type of Process Check) as a powerful method for improving team performance. Team Norms are updated as a result of each Check.

The purpose for these Team Process Checks is to allow your team to collect data, in a non-judgmental form (i.e., there is no good or bad associated with the responses), on how the team is doing. If the Process Check uncovers areas of concern, then your team can use the check as the starting point for making some improvements in the way the team is performing. The Instructors will be reviewing these Process Checks to see when teams may need outside facilitation to help them overcome some team difficulty. Doing this assignment is a team activity and must be done as a team. Then, the Peer Evaluation is a confidential and private input to the instructor.

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When you are preparing our Team Process Check you must follow the procedures explained at [class-materials/design-lab/assess/tm-ck.doc](#). and [peer.pdf](#).

Assignment L5 (Project 2)

This is the second of the two projects you will undertake. In this project you will create (i.e., design & build) a product and then demonstrate your device during a final end-of-class celebration, held in lieu of a final exam. This project is less controlled than the first project; your team will be allowed to solve this problem much as they see fit. It is expected, however, that your team will use some of the methods and tools that have been introduced in the earlier parts of the semester. All the work done on this project will be presented according to the class expectations for presentation and will be placed in the team's Design Notebook.

This project offers your team a second chance to pass through all the stages of the problem solving heuristic. As you go through this process again, it is expected that your team will begin to understand more fully how this problem solving process works (i.e., you will begin to really understand why the steps are ordered the way they are, how the results of one step lead to the next step, why it is often necessary to go back and repeat an earlier step in the process, etc.). In other words, it is expected that many of the teams will achieve Analysis Level of Learning for the Problem Solving Process.

The project itself will be described just-in-time. There will be five assignments defined for this project.

Project Assignments

L5a - Team Goals

Your team has a fair amount of freedom concerning what it does and how it does it. This first assignment addresses the issue of what exactly does your team expect or want to accomplish with this project. As a team, generate a large set of possible team goals and select a set of these goals that you will try to accomplish as you work on the project. Try to state the goals in terms that are in some way measurable so that you (and your peers) can tell if you have actually succeeded in reaching the goal. The work in the Design Notebook should meet presentation expectations and show the process the team used in developing and arriving at its set of goals.

L5b - Project Plan

Part of implementation involves planning the activities that are need to accomplish the goals developed in #L5a. Note: the plan that is desired is not the solution (not your artifact) but is rather the delineation and scheduling of all the things that need to happen for you to complete the project.

L5c - Project Development

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Using whatever plan your team developed, continue the development and creation of your device for demonstration at the end of semester celebration. Be sure to keep all the work you do as a team on this project and be sure to present the work using the presentation sandwich in the Design Notebook. You will find it convenient to have several of these sandwiches rather than trying to have a single sandwich for the entire #L5c effort. One way to decide how many different sandwiches to have is to have at least one sandwich for each major task shown in your schedule or Gantt Chart.

L5d - Project Evaluation

This is an oral presentation and evaluation of your project. The assessment will use the Seventh Assessment Checklist. Your team should review this list in preparation for the class. It is expected that you will substantiate your claims of progress with work in the Design Notebook. Your team will make, to another team in the class, a ten to fifteen minute oral presentation of your team's progress and then spend another ten to fifteen minutes answering questions from the assessing team.

In addition to preparing your oral presentation, you must prepare to evaluate another team's device and presentation. Prepare in advance, a list of Musts and Wants for the other team's presentation. Musts and Wants should include items not only about the project, but also the presentation itself. Upon completion of the other team's presentation, you will interview the team to decide if the criteria were met.

L5e - Project Cost Model

The costing model is an Excel spreadsheet. Each row of the spreadsheet is a different material; the materials have been arranged alphabetically. Copy this file and delete the rows that are not applicable to your device (i.e., turn in a cost model that only includes the materials used in your device).

Part of the project requires your team to calculate the material cost for your device. Each team must look at the collection of materials they used in their device and determine a cost. This includes items used as a structural part of the device, all items used to hold the device together (e.g., screws, glue, etc.), and any item used to make the device function (e.g., string, springs, axles, wire, etc.). You do not need to include the cost of items used to make the device aesthetically pleasing (e.g., paint, decals, etc.).

Assignment L6 (Team Exam)

Towards the end of the semester, you will take two comprehensive exams, one an individual exam and one a team exam. The team exam will focus on demonstrating Comprehension and Application Levels of Learning for material covered in the course. Both parts of the exam are closed book, workbook and notes. No computers will be permitted. You may not have a crib sheet or an already written out agenda but your team may bring any empty Template (e.g., Duncker, KT & UDesign Templates) for the team

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portion of the exam. You must come to class able to demonstrate your knowledge from individual or team memory.

For the team part of the exam, a problem scenario will be set and you will then be asked to solve some problem related to the scenario. As a team, you will work on the problem, developing the team's solution to the problem. Your team's solution will consist of all the work products you generate while working the problem. It is expected that the work products will be presented using the Presentation Sandwich (expected for all technical work). Aside from testing your team's ability to use the problem solving heuristics, the team portion of the exam will also be testing your team's ability to function as a team. The team portion of the exam will be assessed using the Team Exam Checklist that you must print and bring to class and attach to your exam.

Your team should bring whatever supplies they think will be needed to carry out the team portion of the exam (blank paper, post-its, pens, templates, etc.). There will be NO supplies available from the Course Instructors.

Assignment L7 (The Celebration)

The University encourages all classes to hold some sort of comprehensive end-of-term activity. The course faculty has agreed to use the Celebration as this activity. Preparing and taking part in the Celebration does not entail doing anything more than you have already planned to do.