

Code of Honor Policy:

All work you submit for a grade in this class must be original and your own. Work copied or adapted from other sources must include appropriate references to those sources. You are encouraged to seek help from the instructor, TAs and fellow students but when you submit work for grading it must be your own work and not copied in whole or in part from another source unless properly indicated as such. If you work in collaboration with a classmate on an assignment or project, it is required that you note any collaborative work on the assignment you submit. If you have any questions related to collaborative work, please ask before you submit the work.

Class Schedule and Course Topics:

A class session schedule is posted on Concourse and includes due dates for all required student work. Some session topics and due dates WILL BE moved, added or deleted as the semester progresses so you are encouraged to regularly review this document. The in-class quiz that is scheduled for Tuesday, Nov. 30 is one date that is fixed and you are strongly encouraged to make every effort to avoid scheduling extended vacations, interviews, etc. in conflict with that event.

Textbooks: There is no required text for this course.

Additional References and Supplementary Information:

Periodically additional information sources will be provided via handouts, web-links or on Concourse.

Instructor:

Stephen Batill, 360 Fitzpatrick Hall
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Office Hours: Monday and Thursday – 3 – 5 p.m. but you should feel free to stop by my office at any time for assistance or to schedule an appointment.

Teaching Assistants:

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UNIVERSITY OF NOTRE DAME
DEPARTMENT OF AEROSPACE AND MECHANICAL ENGINEERING
AME30362: Design Methodology, Fall 2010

Syllabus as of: Oct. 20, 2010

The following summarizes the class session topics, pre-class assignments, and the due dates for the projects and homework. This document will be updated during the semester so you are encouraged to **check it regularly**. Please note that the Concourse Quizzes (C-Quiz) may include questions on pre-class assignments up to and including the day the Quiz is due. The C-Quizzes will open at noon the week before they are due and close at 10:30 a.m. on their due date.

Class Session	Class Session Topics	Pre-class session assignments	Homework or Project Due Dates
1 – 8/24 (Tues)	Intro, Design factors		
2 – 8/26 (Thurs)	Design thinking	C-Quiz 1 VIEW: Genius of Design - Ep.1 (Concourse)	
3 – 8/31 (Tues)	Visual Thinking I		Proj. 1 (slides and notebook)
4 – 9/2 (Thurs)	Visual Thinking II	C-Quiz 2 VIEW: IDEO Deep Dive video (Concourse)	Proj. 1 Peer review
5 – 9/7 (Tues)	Design Process I		Homework 1
6 – 9/9 (Thurs)	Design Process II	C-Quiz 3 VIEW: Genius of Design –Ep.2 READING: Rittel – paper (Concourse)	
7 – 9/14 (Tues)	Customers I		Homework 2
8 – 9/16 (Thurs)	Customers II	C-Quiz 4 VIEW: Genius of Design – Ep.3 (Concourse) READING: Human Centered Design Toolkit http://www.ideo.com/work/item/human-centered-design-toolkit/ READING: Donald Norman’s perspective http://www.jnd.org/dn.mss/human-centered.html	
9 – 9/21 (Tues)	Guest Presentation		
10 –9/23 (Thurs)	Benchmarking and Reverse Engineering	C-Quiz 5 VIEW: Genius of Design – Ep. 4 (Concourse) READING: Wikipedia - benchmarking http://en.wikipedia.org/wiki/Benchmarking READING: Wikipedia - reverse engineering http://en.wikipedia.org/wiki/Reverse_engineering	Proj. 2 – GRP 1 Homework 3
11 –9/28 (Tues)	Function I	READING: Excerpts from Product Design: Fundamentals and Methods by Roozenburg and Eekels, Sections 4.2, 5.32 and 7.52 (Concourse)	Proj. 2 – GRP 2 Homework 4
12 – 9/30 (Thurs)	Function II	C-Quiz 6	Proj. 2 – GRP 3
13 – 10/5 (Tues)	Specifications I	READING: Interactive tutorial: House of Quality http://www.webducate.net/qfd/qfd.html	Proj. 2 – GRP 4 Homework 5
14 – 10/7 (Thurs)	Specifications II	C-Quiz 7 READING: SAE Paper 2009-01-0529, Pages 1-3, 6-9, (eReserve) VIEW: Genius of Design – Ep. 5 (Concourse)	Proj. 2 – GRP 5

15–10/12 (Tues)	Concept Generation I	READING: Idea Generation in Groups, Pages 76-82, 84-86) (eReserve) READING: Delft Design Guide – Brainstorming (Concourse)	Proj. 2 – GRP 6 Homework 6
16–10/14 (Thurs)	Concept Generation II	C-Quiz 8 READING: The Eureka Hunt (eReserve)	Proj. 2 – GRP 7
17–10/26 (Tues)	Concept Generation III	READING: Delft Design Guide – Morphological Chart (Concourse)	Proj. 2 – GRP 8 Homework 7
18–10/28 (Thurs)	Concept Selection I	C-Quiz 9 READING: Delft Design Guide – Weighted Objectives Method (Concourse)	Proj. 2 – GRP 9
19 – 11/2 (Tues)	Concept Selection II	READING: Electric-powered Vehicle Model (Concourse)	Proj. 2 – GRP 10 Proj. 4 – Draft Homework 8
20 – 11/4 (Thurs)	Concept Embodiment Trade Studies I	C-Quiz 10	Proj. 2 – GRP 11
21 – 11/9 (Tues)	Concept Embodiment Trade Studies II		Proj. 2 – GRP 12 Proj 4–Draft Reviews Homework 9
22–11/11 (Thurs)	Design Methods Overview		Proj. 2 – GRP 13
23–11/16 (Tues)	EG Economics and EG Ethics I	READING: ASME Code of Ethics and ASME Criteria for Interpretation of the Canons (Concourse) READING: From the “Fundamentals of Engineering Supplied-Reference Handbook: Pages 114-120 on Engineering Economics and pages 121-122 on Engineering Ethics (Concourse)	Proj. 4 – Final and Peer Review Homework 10
24–11/18 (Thurs)	EG Economics and EG Ethics II	READING: National Society of Professional Engineers Ethics Case Study 07-4: Credit for Engineering Work – Implying Responsibility (Concourse)	
25–11/23 (Tues)	EG Economics and EG Ethics III	READING: National Society of Professional Engineers Ethics Case Study 08-10: Public Welfare – Design of Medical Equipment (Concourse)	Proj. 3 - Portfolio
26–11/30 (Tues)	EG Econ and Ethics Quiz (in class, closed book)		Proj. 3 Presentations and Portfolio Briefings Begin
27 – 12/2 (Thurs)	Project Planning		Proj. 5 – last completion date
28 – 12/7 (Tues)	Guest Presentation		
29 – 12/9 (Thurs)	Project Planning	C-Quiz 11	

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Project 1 – A design experience

Project Due Date: **Tues. Aug. 31, 2010 – Presentation slides and design notebook**
 Thurs. Sept. 2, 2010 – Evaluation and written critique

This project will provide an opportunity to develop a design concept for a useful product. The product will be designed to exploit new uses for existing components of a current product. You will have the freedom to identify the purpose and potential customers for the new product, develop a design concept for the product and decide how best to present your design concept. The purpose for the project is to explore the issues and ideas that you encounter as you work through this experience thus documenting the experience is the most important part of the project.

Project Description:

The XYZ mousetrap company has determined that, due to new developments in the mouse-trapping business, it needs to explore innovative opportunities to utilize its current materials and manufacturing infrastructure. You are tasked with developing a new, desirable, feasible and viable product that uses all or some of the components of the current mousetrap. You will then collaborate with other engineers to evaluate a group of concepts, select the most promising candidate concept and develop a 2-minute “pitch” to present that concept to the class.

Project Requirements:

There are four basic requirements:

1. Develop a concept for a new product based solely upon the components used in the mousetrap you were provided. You can modify existing components to develop your product.
2. Develop a 3-viewgraph presentation, (hand drawn or computer generated) for presentation to a small group of fellow design engineers. You should be prepared to present your concept to this group in 2 minutes. You will submit an extra hardcopy of the 3-slide presentation separate from your notebook.
3. Maintain a detailed project notebook documenting ALL your activities and results related to the project. Obviously you can't document every thought but all key ideas, steps taken, information developed and all paperwork generated during the project (words, sketches, doodles, models, prototypes, photos, pictures, etc.) should be part of this notebook. For this project the term “notebook” can be loosely interpreted. You can use either a small, dedicated notebook in which your work is written or taped **or** simply collect all the papers developed for the project and staple them into a single “notebook.” All of the information in the notebook can, and probably should, be handwritten and this notebook should contain a copy of your 3 slides.
4. Complete a Peer Evaluation (form provided) and written critique (limit of 350 words) of the work of one of the other engineers in your small project team and discuss your assessment with this engineer. The written critique should focus on an assessment of the effectiveness of the 3-slide presentation material in conveying the potential for the proposed concept and specific recommendations for improvement of the presentation. The critique is **NOT** an assessment of the potential of the concept itself but should focus solely on the effectiveness of the presentation material. **The Requirement #4 items are due on Thurs. Sept. 2, 2010 by the beginning of the class session.**

Each student will need to bring **two legible copies of the 3-slide presentation to class on Tuesday, Aug. 31, 2010**. One copy will be submitted to the instructor as part of the notebook and the second copy will be given to a fellow student to review and critique.

As you work on this project you are asked to keep informal records of the amount of time you spent working on each part of the project.

Project #1 Peer Evaluation Criteria:

Designer: _____

Presentation: 9 pts total _____

1. Described the potential customer for the product/s [3] _____
 - 0 - no mention of customer
 - 1 - customer implied but not explicitly stated
 - 2 - customer stated but relationship between customer and product's features is unclear
 - 3 - clear statement of potential customer and how the customer is engaged by the concept

2. Described the function of the product/s [3] _____
 - 0 - no mention of how the concept would function
 - 1 - some indication of function but not explicitly stated
 - 2 - function stated but not effectively communicated in materials presented
 - 3 - clear, concise and effective description of the function of the concept

3. Described an effective utilization of current materials [3] _____
 - 0 - no mention of the use of the current product materials
 - 1 - some mention of the use of the existing materials
 - 2 - specific components indicated but unclear as to how they will be modified or assembled
 - 3 - effective description for each existing component and their use in the new product

Evaluator's Printed Name and Initials: _____

After the two engineers discuss this form and the written critique on Thursday, Sept. 2, the designer will provide her/his assessment of the effectiveness of the critique using the second part of this form.

Designer's assessment of Evaluator's written critique:

1. Comments on effectiveness of the 3-slide presentation [2] _____
 - 0 - no comments on effectiveness
 - 1 - limited comments on effectiveness
 - 2 - Useful comments on effective elements and areas of concern

2. Specific recommendations for improvement [2] _____
 - 0 - no recommendations
 - 1 - limited recommendations, unsure how they could be used to improve the submission
 - 2 - effective and useful recommendations that would assist in improving the presentation

Designer's Printed Name and Initials: _____

This form will be used by the Instructor to evaluate Project 1.

Project #1 Instructor's Evaluation Criteria: **Designer:** _____

Presentation: 9 pts total _____

1. Described the potential customer for the product/s [3] _____
 - 0 - no mention of customer
 - 1 - customer implied but not explicitly stated
 - 2 - customer stated but relationship between customer and product features is unclear
 - 3 - clear statement of potential customer and how the customer is engaged by the concept

2. Described the function of the product/s [3] _____
 - 0 - no mention of how the concept would function
 - 1 - some indication of function but not explicitly stated
 - 2 - function stated but not effectively communicated in materials presented
 - 3 - clear, concise and effective description of the function of the concept

3. Described an effective utilization of current materials [3] _____
 - 0 - no mention of the use of the current product materials
 - 1 - some mention of the use of the existing materials
 - 2 - specific components indicated but unclear as to how they will be modified or assembled
 - 3 - effective description for each existing component and their use in the new product

Comments:

Notebook: 9 pts total _____

1. Written content [3] _____
 - 0 - no written content
 - 1 - limited written content but sporadic and not effective in documenting the experience
 - 2 - consistent written content but not concise or effective in documenting the experience
 - 3 - concise and effective use of words to communicate key issues in the experience

2. Visual content [3] _____
 - 0 - no visual content
 - 1 - some limited visual content but sporadic and unclear
 - 2 - consistent use of visual content but not effective in documenting the evolution of the concept
 - 3 - consistent use of visual content that effectively documented the evolution of the concept

3. Overall organization and presentation of the notebook [3] _____
 - 0 - disorganized and illegible
 - 1 - some logical order but difficult to follow, minimal effort
 - 2 - chronological presentation of effort and evolution of ideas as the concept was developed
 - 3 - effectively communicates the designer's project experience

Comments:

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Project 2, Option A – Book Review and Presentation

Project Due Date: Beginning Sept. 23, 2010 and continuing through Nov. 11, 2010

This project will give you the opportunity to expand your perspective on design by reading and critiquing a book related to design. You will then work with a group of classmates to develop a presentation to share your experience with the class.

Project Description:

You are required to read a book related to the topic of design. This book will be assigned to you from the following list of titles. The books are primarily available through on-line vendors. You will be assigned to a project group and this group will discuss and critique the book and prepare a 20-minute formal in-class panel presentation and coordinate a discussion based upon the ideas developed in the book. The goal of the presentation is to provide both a brief overview as well as an in-depth evaluation and assessment of what the group identifies as the key elements of the book. The group will also write a book review providing their assessment of the value of this book in providing information and perspectives related to design theory, practice or philosophy. The review should stress insights gained and issues raised by reading the book. Each individual will also have the opportunity to provide a critique and feedback to another Project 2 group.

Project Requirements:

Individual Requirements

1. Each member of the group should acquire and read the assigned book and prepare an outline for both the presentation and review and in particular explicitly state three key take-away points from your perspective. The outline from each student should be submitted with the hardcopy of the group's book review.
2. Each member of the group will prepare and submit a confidential peer review for the other members of their group assessing their contributions to the project. The form for the peer review will be provided. It is expected that all members of the group will contribute to all phases of the project.
3. Each individual will be assigned to prepare and submit an assessment of both the panel discussion and the review paper for another Project 2 group (either Option A or B). Details on that element of this project will be provided later in the course. That assessment will be due within one week of the presentation/review you will be reviewing.

Group Requirements

1. The group should work together to coalesce the individual outlines and key points to prepare a:
 - a. Panel discussion and presentation: Each group will be assigned a date to present a panel discussion of their book. The format for the presentation is at the group's discretion but the presentation should last approximately 20 minutes with all members of the group participating. Limited use of slides is permitted but this is not a slide presentation. Emphasis should be placed upon your interpretation of the book's key themes not a summary of the book. The group should explicitly emphasize the three key take-away points from the group's discussion of the book. After the presentation the group will moderate an engaging 10-minute class discussion on the book's topics.
 - b. Book review: Each group will prepare a formal book review (not book report) highlighting their assessment of the value of this book in providing information and perspectives related to design. The review should be approximately 1500 words but not exceed two typed pages. The review will be submitted in both .pdf and hardcopy and is due the day of the group's presentation.

List of Books:

Pink, Daniel H., A Whole New Mind, 2005, Riverhead Books, New York, New York

Kelley, Tom, The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm, 2001, Currency Book, New York, New York

Simon, Herbert A., The Sciences of the Artificial: Third Edition, 1996, The MIT Press, Cambridge, Massachusetts

Brown, T., Change by Design, 2009, HarperCollins, New York, New York

McDonough, William, and Braungart, Michael, Cradle to Cradle: remaking the way we make things, 2002, North Point Press, New York, New York

Bucciarelli, J.L., Designing Engineers, 1994, The MIT Press, Cambridge, Massachusetts

Kelley, Tom, The Ten Faces of Innovation, 2005, Currency-Doubleday, New York

Norman, Donald A., The Design of Everyday Things, 1990, Currency-Doubleday, New York, New York

Brooks, F.P., Design of Design, 2010, Pearson Education Inc., Boston, Massachusetts

Papanek, V., Design for the Real World – Human Ecology and Social Change (Second Edition), 1984, Academy Chicago Publ., Chicago, Illinois

Petroski, H., Invention by Design – How engineers get from thought to thing, 1996, Harvard University Press, Cambridge, Massachusetts

Thackara, J., In the Bubble – Designing in a Complex World, 2006, The MIT Press, Cambridge, Massachusetts

Project Evaluation Criteria:

The project evaluation criteria and peer review forms will be provided as separate documents.

Project 2 – Book Review - Option A

Evaluation Criteria:

Group: _____

Panel presentation and discussion: 18 pts total _____

1. Overview of the book as a whole [3] _____
 - 0 - not included in the presentation
 - 1 – included a summary of the book’s topics but did not identify a central theme
 - 2 – concise and effective summary of the book’s topics and central theme
 - 3 – concise summary of the book’s topics and central theme in the context of design theory or practice

2. Effectiveness in identifying and describing the book’s key themes [6] _____
 - 0 - no specific indication of key themes – little more than a summary of the book’s content
 - 2 – a number of specific themes identified but no indication as to why they were considered important
 - 4 – a number of specific themes identified with statements as to why they were considered important
 - 6 – concise description of key themes and compelling rationale as to why they were considered important

3. Assessment of the effectiveness of the book’s key themes [6] _____
 - 0 – no attempt to assess the effectiveness of the development of the key themes
 - 2 – some attempt to assess the effectiveness of the development of the key themes
 - 4 – assessment of the effectiveness of some of key themes as supported by specific examples
 - 6 - assessment of the effectiveness of all of key themes as supported by specific examples

4. Effectiveness in initiating and moderating a discussion [3] _____
 - 0 – not able to initiate a class discussion of the book
 - 1 – limited engagement in a discussion of the book by the class
 - 2 – initiated a discussion but the discussion was not focused on the book or its key themes
 - 3 – quickly initiated a discussion and effectively managed the discussion while focusing on the key themes

Book Review: 15 pts total _____

1. Assessment of the book’s value in providing information and perspectives [4] _____
 - 0 – not included
 - 2 – explicit summary of the information and perspectives on design provided in the book
 - 4 – explicit summary of the information and perspectives on design provided in the book with an assessment of the value of the book in expanding your understanding of design

2. Insights gained [4] _____
 - 0 – does not explicitly indicate any insights gained
 - 2 – indicates a number of insights gained
 - 4 – engaging discussion that provides insights and how they were influenced by the book

2. Issues or concerns raised [4] _____
 - 0 – does not explicitly indicate any issues or concerns
 - 2 - indicates a number of issues raised or concerns generated related to design theory or practice
 - 4 – engaging discussion that identifies issues and concerns and how they were influenced by the book

3. Organization and presentation [3] _____
 - 0 – no obvious organization, not well written, inadequate proofreading
 - 1 – lacks organization but well written and reviewed
 - 2 – well written and provides information that would assist in determining if one should read the book
 - 3 – well written and well organized and would assist in determining if one should read the book

Evaluator’s Printed Name and Initials: _____

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Project 2, Option B – Product Review and Presentation

Project Due Date: Beginning Sept. 23, 2010 and continuing through Nov. 11, 2010

This project will give you the opportunity to expand your perspective on product design by deconstructing and assessing different artifacts designed to meet a similar need. You will then work with a small group of classmates to develop a presentation and product review to share your experience with the class.

Project Description:

Each group is required to identify a class of products (e.g. toaster, drill, printer, hair dryer, etc.) with mechanical components that include at least 2 systems based upon underlying principles from the following list: thermal, fluid, dynamic, kinematic. Your group will then pool funds (the same for each but **not to exceed \$15** per student) to acquire at least 2 different, functioning products in that class. The group will then evaluate the performance and deconstruct the different artifacts with the intention of assessing the performance of each product, its design and assembly. The group will then prepare a 20-minute formal presentation and coordinate a discussion focused on your assessment of the design of the products and their performance. The goal of the presentation is to provide both a brief overview as well as an evaluation and assessment of the key features of the products and a qualitative comparison of strengths and weaknesses. The group will also write a formal product review providing their assessment of key design features and the quality of the products. Finally, each individual will also have the opportunity to provide a critique and feedback to another Project 2 group.

Project Requirements:

Individual Requirements

1. Each member of the group will submit a confidential peer review for the other members of their group assessing their contributions to the project. The form for the peer review will be provided. It is expected that all members of the group will contribute to all phases of the project.
2. Each individual will prepare and submit an assessment of both the presentation and the review paper for another Project 2 group (either Option A or B). Details on that element of this project will be provided later in the course. That assessment will be due within one week of the presentation/review you will be reviewing.

Group Requirements

1. Product testing and disassembly: Groups will identify the product class they wish to evaluate and submit that information to the instructor for approval. **DO NOT purchase anything prior to receiving written approval.** Approvals will be provided on a first-in-first-out basis. Once product class approval is provided, the group should acquire at least two different functioning products in the same class. The group should define and conduct a simple series of performance tests for the products (qualitative results are very acceptable.) After testing, the products should be disassembled and their design elements and features recorded and evaluated. Space in the AME Design Studio, B-19 Fitzpatrick or the Stinson-Remnick shop and a set of hand tools will be provided if requested.
2. Panel discussion and presentation: Each group will be assigned a date to present the results of the testing, disassembly and assessment to the class. The format for the presentation is at the group's discretion but the presentation should last 20 minutes with all members of the group participating. One might expect an extensive use of visual aides for this presentation. Emphasis should be placed on your assessment of the products and comparisons of their features. The group should explicitly emphasize the key features and the quality of the products. After the presentation the group will moderate an engaging 10-minute class discussion on this experience.
3. Product review: Each group will prepare a formal, written product review highlighting their assessment of the key design and assembly features of the products they evaluated. The review should be approximately 1500 words but not exceed two typed pages. The review will be submitted in both .pdf and hardcopy and is due the day of the group's presentation.

Project 2 – Product Review - Option B

Evaluation Criteria:

Group: _____

Panel presentation and discussion: 18 pts total _____

1. Overview of the product class and general function [3] _____
 - 0 - not included in the presentation
 - 1 – included a brief description but didn't indicate key customers or primary uses
 - 2 – oral summary of the product class with insights on key customers, their needs and primary uses
 - 3 – concise visual and oral summary of the product class with insights on key customers, their needs and primary uses

2. Performance testing and evaluation results [6] _____
 - 0 - not included in the presentation
 - 2 – some test results (qualitative) provided and some comparisons made
 - 4 – test results, qualitative and quantitative, provided and effective comparisons made
 - 6 – concise visual and oral summary of test results, qualitative and quantitative, provided and effective comparisons

3. Disassembly and assessment [6] _____
 - 0 – not included in the presentation
 - 2 – limited discussion of the issues encountered and observations during disassembly
 - 4 – discussion of the issues encountered and observations during disassembly with product comparison
 - 6 - concise visual and oral summary of issues encountered and observations during disassembly with product comparisons

4. Effectiveness in initiating and moderating a discussion [3] _____
 - 0 – not able to initiate a class discussion of the products
 - 1 – limited engagement of the class in a discussion of the products and their assembly
 - 2 – initiated a discussion but the discussion was not focused on the product's design and assembly
 - 3 – quickly initiated a discussion and effectively focused the discussion on the product's design and assembly

Product Review: 15 pts total _____

1. Evaluation of the products' overall quality [4] _____
 - 0 – not included
 - 2 – some comments on the perceived quality of each product without justification based upon your results
 - 4 – a concise summary of the perceived quality of each product based your testing and disassembly results

2. Key design features – strengths and weaknesses [4] _____
 - 0 – does not explicitly indicate key design features
 - 2 – explicit indication of key design features for each product
 - 4 – explicit description of key design features for each product with specific strengths and weaknesses indicated

2. Key assembly features – strengths and weaknesses [4] _____
 - 0 – does not explicitly indicate key assembly features
 - 2 – explicit indication of key assembly features for each product
 - 4 – explicit description of key assembly features for each product with specific strengths and weaknesses indicated

3. Organization and presentation [3] _____
 - 0 – no obvious organization, not well written, inadequate proofreading
 - 1 – lacks organization but well written and reviewed
 - 2 – well written and provides useful information that would assist in determining which product to purchase
 - 3 – well written and well organized and would assist in determining which product to purchase and how to improve the design of each

Evaluator's Printed Name and Initials: _____

Reviewer: _____

AME30362: Fall 2010 Design Methodology - Confidential Peer Review - Project 2

This form is used to provide a confidential evaluation of each member of your project group - **INCLUDING YOURSELF**. Please consider each item carefully. Rate each member of the team in each category area, on a scale from 0-10 with a ten being the highest rating. **THE AVERAGE FOR THE ENTIRE GROUP MUST BE "5" FOR EACH CATEGORY**. You have a total of 5 x (the number of people in your group) points to distribute to all the group members in each category. You will have to select your own relative merit on that scale and it is important that you are consistent.

For you to receive credit for Project 2 this form must be completed and **submitted in the CLASS SESSION immediately following the class session in which your group makes their presentation.**

- a. Enter the last names of every member of your Project 2 group in alphabetical order.
- b. Rate each member of the group (including yourself) in each of the 10 categories on a scale from 1-10.
- c. Compute and enter the total points distributed for each category and make sure the average score for each category is 5.
- d. Compute the total number of points given to each member of the group and enter the TOTAL POINTS.
- e. Fold in half, staple closed and write your name and group number on the outside of the paper.

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL POINTS
LAST NAMES IN ALPHABETICAL ORDER											
1.											
2.											
3.											
4.											
5.											
6.											
TOTAL											

CATEGORIES:

1. PUNCTUALITY AND ATTENDANCE AT GROUP MEETINGS
2. ABILITY TO FOLLOW THROUGH ON COMMITMENTS AND RESPONSIBILITIES
3. ABILITY TO COMMUNICATE WITH OTHERS – WRITTEN AND ORAL
4. WILLINGNESS TO CONTRIBUTE IDEAS
5. TEAM FOCUS
6. TAKES INITIATIVE BUT ALSO ALLOWS OTHERS TO CONTRIBUTE
7. CONSISTENT AND APPROPRIATE LEVEL OF EFFORT FOR THIS PROJECT
8. WILLINGNESS TO SHARE THE WORKLOAD AND ASSIST OTHERS AS NEEDED
9. PROVIDES HIGH QUALITY WORK
10. TECHNICAL COMPETENCE

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Project 3 – Design Study

Project Due Date: Tues. Nov. 23, 2010, In-class presentations – Tues. Nov. 30, 2010

Design methods associated with various phases of the design process will be introduced during the course and you will apply these methods to the development of a new product concept. The results of Project 3 will be a design study portfolio and a slide presentation describing your concept and its development. The objective for the product development project will be mechanical devices to assist temporarily or permanently, physically limited or disabled people in performing required or desired activities.

Project Description:

This project will focus on the conceptual design phase and provide an opportunity to apply various synthesis and analysis methods. During the semester you will be introduced to a number of methods and selected homework assignments will give you the chance to apply the methods to this project. Your homework submissions will be critiqued and you will have the opportunity to revise your initial efforts as you continue to develop your design. At the end of the semester you will assemble all your work (initial homework submissions, peer critiques and your revisions) into a portfolio that will document your design study. Much of the portfolio will emphasize visual thinking and communication methods though written descriptions and analyses will be included. This project is primarily intended to provide experience using a number of design methods and does not represent a complete concept design study, thus emphasis will be placed upon **effective application of the methods and presentation of the information** they provide, NOT the actual design concept. Details on the design methods (i.e. homework assignments) that are required for the portfolio will be provided throughout the semester.

Project Requirements:

Each student will develop:

1. Project portfolio: The portfolio packaging should attempt to conserve paper and other material resources. The portfolio must be secured with a single staple or alligator clip. The portfolio should contain the following primary elements sequenced in this order:
 - a. Final Concept Summary: A one-page (single space, 12 pt font) written summary of your proposed concept highlighting the target customer and key design features of your concept.
 - b. Slide presentation: This should be a concise, primarily visual, representation of your design concept. The presentation should include insights gained from the design methods that you believe to be most useful in describing your customer and your concept. This must be limited to 4 slides with the format and content at your discretion. The slides ALONE must also be submitted via Concourse in .pdf format by the project due date. Students will be selected via an on-line poll to present their slides to the class on Nov. 30th.
 - c. External assessment: You will need to identify someone, not a current ND student, to provide you with a written assessment of your design concept as represented by the **final concept summary and the slide presentation**. The class will develop a set of questions to provide to this reviewer as a basis for their critique. This person should only be identified in a “generic” fashion but ideally it would be an engineering professional (e.g. relative, neighbor, internship mentor, future employer, etc). This section of the portfolio will include their response to the critique questions and a one-paragraph (100 word limit) generic description of the reviewer’s qualifications to provide the evaluation.
 - d. Design study results: This section should begin with a **completed** Summary Sheet (format provided with the template). It also contains your final revised version of the application of each of the required design methods. Your initial homework submission and the peer evaluations you received must follow the revised version for each design method included in the portfolio.
2. Instructor presentation: Between Nov. 30 and Dec. 9 each student will meet with Prof. Batill and have approximately 10 minutes to present their concept and review their portfolio.

Project #3- Design Study Portfolio Evaluation Criteria

Designer: _____

Final Concept Summary: 5 pts total _____

1. Target customer for the concept [3] _____
- 0 - no mention of a customer
 - 1 – customer indicated but the customer’s need/desire not effectively linked to the concept
 - 2 – customer and their needs described but not effectively linked to the design of the product
 - 3 – compelling description of the customer, their needs and how they influenced the product’s design
2. Concept’s key design features [2] _____
- 0 - no explicit description of key features
 - 1 – a shopping list of “key” features but no explicit details as to why they are key
 - 2 – clear, concise and prioritized description of key features and effective rational as to their importance

Slide Presentation: 14 pts total _____

1. Written content [6] _____
- 0 - no written content
 - 2 - limited written content but used sporadically or excessively
 - 4 – appropriate amount of written content but not effective in conveying a clear message for each slide
 - 6 - concise and effective use of words to communicate the rational for the concept on each slide
2. Visual content [6] _____
- 0 - no visual content
 - 2 - limited visual content but used sporadically and/or unclear as to its purpose
 - 4 - consistent use of visual content but not effective in conveying a clear message
 - 6 - consistent use of visual content to communicate the rational for the concept on each slide
2. Communicates the key features of the design concept [2] _____
- 0 – does not identify the key design features
 - 1 – various features indicated but design priorities not clearly communicated
 - 2 – key features clearly and concisely communicated

External Assessment: 2 pts total _____

- 0 – not included
- 1 – reviewer responses included without the appropriate reviewer description
- 2 – reviewer responses included with an appropriate, generic reviewer description

Design Study Results: 16 pts total _____

1. Completeness [10] _____
- 0 – less than 50% of the required design methods
 - 4 - > 50% of the required design methods (some missing revision, initial submission, or critique/recomm.)
 - 6 – > 75% of the required design methods (some missing revision, initial submission, or critique/recomm.)
 - 8 - all of the required design methods (some missing revision, initial submission, or critique/recomm.)
 - 10 – all of the required design methods with each including the revision, initial submission, critique/recomm.
2. Quality of final revised versions [6] _____
- 0 – no obvious attempt to improve upon initial submissions
 - 2 – some revisions to initial submissions but some still not appropriate applications of the method
 - 4 – effective final versions indicating appropriate application of the methods
 - 6 – well presented and obvious attempts to incorporate recommendations and improve initial submission

Portfolio Organization and Packaging: 3 pts total _____

- 0 – does not comply with project requirements
- 1 – complies with project requirements on formatting or packaging but not both
- 2 – complies with project requirements on formatting and packaging
- 3 – complies with project requirements on formatting and packaging with an engaging cover

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Project 3 – Design Study

The following questions should be submitted to your external reviewer for comments along with the: 1) Concept Summary and 2) Slide presentation. You are encouraged to provide them with a copy of the Project 3 description and any other information that you believe will assist them in responding to these questions. Format their responses in a manner that explicitly indicates their response to each question.

1. What was your initial reaction to product concept?
2. What was your initial reaction to the Concept Summary and Slides?
3. Does the presentation effectively communicate the design concept and the process used to develop it?
4. What is the most significant takeaway that you will remember about the Summary and Slides?
5. What recommendations could you offer regarding the presentation of the information provided to you?
6. What recommendations could you offer regarding the product concept?

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Project 3 – Design Study
Instructor Presentation (Nov. 30 – Dec. 9, 2010)

The final requirement for this project is:

Instructor presentation: Between Nov. 30 and Dec. 9 each student will meet with Prof. Batill and have approximately 10 minutes to present their concept and review their portfolio.

During these brief sessions you will be given approx. 3 minutes to present your “slides” and then respond to questions related to the application of the design methods that make up your portfolio. The purpose of this brief meeting is not to determine what you don’t know but to determine what you’ve learned. There is no intention to make it a stressful or uncomfortable experience. The purpose is to give you the opportunity to describe what you have learned in the process of performing this design study and building your portfolio.

The sessions will be scheduled during the following date/times:

Tues. Nov. 30, 3:30 – 5:30 p.m.
Wed. Dec. 1, 9:00 – 11:00 a.m.
Fri. Dec. 3, 9:00 – 11:00 a.m. AND 3:30 – 5:30 p.m.
Mon. Dec. 6, 9:00 – 11:00 a.m. AND 3:30 – 5:30 p.m.
Wed. Dec. 8, 9:00 – 11:00 a.m. AND 3:30 – 5:30 p.m.
Thur. Dec. 9, 3:00 – 5:00 p.m.

You are asked to sign-up on the sheet posted on the bulletin board outside Dr. Batill’s office. The sign-up sheet will be available beginning at 9:00 a.m. on Friday, Nov. 19. Please sign up **NO LATER THAN 3:00 p.m** Tues. Nov. 30. Each meeting will be scheduled for 10 minutes.

You are also asked to arrive at least 10 minutes before your scheduled time and please note the somewhat unusual meeting times. If you don’t schedule a time or schedule a time and miss your appointment (unless you are provided with an official University excuse) you will not have the opportunity to complete this element of Project 3. There will be no make-up sessions.

Your NAME (somewhere!)

Your unique
Cover
design

The name of
your product
(somewhere!)

Final Concept Summary

A one-page (single space, 12 pt font) written summary of your proposed concept highlighting the target customer and key design features of the concept.

**The First slide MUST contain the name
of your product BUT it must NOT
contain your name – nor should your
name be anywhere on the 4 slides!**

Slide Presentation Slide 1

Slide Presentation - Slide 2

Slide Presentation - Slide 3

Slide Presentation - Slide 4

Completed External Reviewer Comment Form
(to be provided)

100 word “generic” description of the external
reviewer

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Project 3 – Design Study Grade and Revision Summary

Homework 1: Concept Map

Grade on initial submission (if assigned)	
Grade you would recommend for the revised version of the assignment	

Revisions: Concise statement of the key points you addressed in your revision for Homework 1 (less than 50 words)

Homework 2: Design Brief

Grade on initial submission (if assigned)	
Grade you would recommend for the revised version of the assignment	

Revisions: Concise statement of the key points you addressed in your revision for Homework 2 (less than 50 words)

Homework 3: Understanding your customer

Grades on initial submission	
Grade you would recommend for the revised version of the assignment	

Revisions: Concise statement of the key points you addressed in your revision for Homework 3 (less than 50 words)

Homework 4: Activity Diagram

Grade on initial submission	
Grade you would recommend for the revised version of the assignment	

Revisions: Concise statement of the key points you addressed in your revision for Homework 4 (less than 50 words)

Homework 5: Function Structure Diagram

Grade on initial submission	
Grade you would recommend for the revised version of the assignment	

Revisions: Concise statement of the key points you addressed in your revision for Homework 5 (less than 50 words)

Homework 6: Engineering Design Requirements – House of Quality

Grade on initial submission	
Grade you would recommend for the revised version of the assignment	

Revisions: Concise statement of the key points you addressed in your revision for Homework 6 (less than 50 words)

Homework 7: Prototyping for Ideation

Grade on initial submission	
Grade you would recommend for the revised version of the assignment	

Revisions: Concise statement of the key points you addressed in your revision for Homework 7 (less than 50 words)

Homework 8: Preliminary Design Concept

Grade on initial submission	
Grade you would recommend for the revised version of the assignment	

Revisions: Concise statement of the key points you addressed in your revision for Homework 8 (less than 50 words)

THE DESIGN STUDY SUMMARY FORM MUST BE CONTAINED ON TWO SHEETS OF PAPER

Revised submission for Homework 1

Critique and
Recommendation Form
for Homework #1

Original
submission for
Homework 1

Revised submission for
Homework 2, etc.

Critique and
Recommendation Form
for Homework #2, etc.

Original
submission for
Homework 2, etc.

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Project 4 – Component Selection Guidelines

Project Due Dates: Draft Submission - Tues. Nov. 2, 2010

Draft Report Reviews – Tues. Nov. 9, 2010

Final Submission and Peer Review – Tues. Nov. 16, 2010

You will work with a group to collect, evaluate, organize and present information to assist designers in the selection of a specific class of mechanical components. This project will allow you to develop expertise with an important class of components and to **develop a useful design tool** for future ME design projects.

Project Description:

You will be assigned to a project team and each team will be assigned a component class. Each team will work to develop a designer-friendly “tool” that will provide information and specific guidelines that will assist future designers in the selection and purchasing of electro-mechanical components or materials. This project is not about designing the components, it is about **designing the guidelines**, and it should provide practical information to assist in selecting and integrating these components into the design of new products or systems. Each group will develop a set of component-selection guidelines that addresses issues related to:

1. Key component definition terminology and performance characteristics,
2. How the components and their performance characteristics are described in the catalogs/websites,
3. Current vendors that are student-project-friendly,
4. Prices, purchasing or shipping requirements,
5. Any other information you deem to be useful.

To assist you in understanding the kinds of components often used in the design of mechatronic engineering projects, you will have access on Concourse to copies of the project reports from AME40463, ME Senior Design, for the spring 2010 semester. These reports include component lists and other information relative to the kinds of components often used in these projects.

Project Requirements:

Group Requirements:

1. Component Selection Guidelines: The project team will prepare a document that is suitable for use by students to assist them in the selection of electro-mechanical components for engineering design projects. The media, presentation and format for the guidelines is at the team’s discretion but it should be user-friendly and consistent with the skill level of a senior-level, mechanical engineering student.
 - a. Draft Guidelines: A complete draft of the guideline document is due in .pdf format by **8:00 a.m.** on Tuesday, Nov. 2, 2010. Submissions details will be provided.
 - b. Final Guidelines: A final version of the guideline document, both as a .pdf and in hardcopy, is due by 11:00 a.m. on Tuesday, Nov. 16, 2010. The hardcopy submission should include the: 1) Revised Final Selection Guideline document, 2) A copy of the draft version of the Guideline document, 3) A copy of each of the reviews and a brief statement of how the team responded to each review.

Individual Requirements:

1. Draft Guideline Review: Each student will be assigned one of another team’s draft reports to review and provide an anonymous critique with recommendations. Two copies of the review are due on Tuesday, Nov. 9, 2010 by 11:00 a.m. An anonymous copy for the team and a signed copy for the instructor. Additional details will be provided on the content and format for the reviews.
2. Peer Review: Each member of the group will prepare and submit a confidential peer review for all the members of their group assessing their contributions to the project. The form for the peer review will be provided.

**Project 4 – Component Selection Guidelines
Draft Design Guidelines Evaluation Form**

Group: _____ **Component Class:** _____

There are two parts to the Evaluation: 1) this form, and 2) a single-page, formal written critique containing two separate sections. The written critique should address: 1) Overall review of the Guidelines including **two** specific strengths and **two** specific weaknesses, 2) Recommendations to address those areas noted as weaknesses. Do NOT INCLUDE your name on the written review.

Print two (2) copies of this form and complete both. Staple one SIGNED copy of this form to your written review for evaluation by the instructor. DO NOT sign the other copy of this form, staple it to a copy of your written review, fold them in half and write the GROUP NUMBER for the group you are reviewing on the outside and submit it in class.

Draft Guidelines: 18 pts total _____

1. Key terminology and performance characteristics [3] _____
 - 0 - not included
 - 1 – terminology included but no obvious attempt to identify key terms or characteristics
 - 2 – included and identify key terms or characteristics but explanations are not useful or effective
 - 3 – included and identify key terms or characteristics with effective, concise visual and written explanations

2. How the catalogs/websites describe the components and their characteristics [3] _____
 - 0 - not included
 - 1 – included but inconsistent and not presented in a fashion that would be useful
 - 2 – includes information that should be useful in EITHER differentiating OR selecting components but not both
 - 3 – concise visual and written information that should be useful in BOTH differentiating AND selecting components

3. Purchasing information [3] _____
 - 0 – not included
 - 1 – little more than a list of vendors
 - 2 – information on vendors and purchasing/shipping but not useful in selecting vendors or purchasing components
 - 3 - concise visual and written information that should be useful in selecting vendors and purchasing components

4. Organization and presentation [3] _____
 - 0 – not organized in a way that encourages or facilitates its use
 - 1 – basic organization of content but presentation not appropriate for major senior class project
 - 2 – effective organization and presentation, few typos, appropriate use of written and visual content
 - 3 – professional presentation – representative of entry-level professional work

5. Utility assessment [6] _____
 - 0 – little useful information and doesn't provide guidelines for component selection
 - 2 – provides some useful information but not sure how to use it help select components
 - 4 – provides useful information and attempts to indicate how to use it help select components
 - 6 – useful information and guidelines and obvious how it can be used to assist in component selection

Evaluator's Printed Name and Initials: _____

[LEAVE THIS BLANK FOR THE COPY THAT WILL BE PROVIDED TO THE DESIGN TEAM]

Reviewer: _____

AME30362: Fall 2010 Design Methodology - Confidential Peer Review - Project 4

DUE: TUESDAY, Nov. 16, 2010 at 11:00 a.m.

This form is used to provide a confidential evaluation of each member of your Project 4 group - **INCLUDING YOURSELF**. Please consider each item carefully. Rate each member of the team in each category area, on a scale from 0-10 with a ten being the highest rating. **THE AVERAGE FOR THE ENTIRE GROUP MUST BE "5" FOR EACH CATEGORY**. You have a total of 5 x (the number of people in your group) points to distribute to all the group members in each category. You will have to select your own relative merit on that scale and it is important that you are consistent.

For you to receive credit for Project 4 this form must be completed and **submitted BY 11:00 a.m. on Tuesday, Nov. 16, 2010**.

- a. Enter the last names of every member of your Project 4 group in alphabetical order.
- b. Rate each member of the group (including yourself) in each of the five (5) categories on a scale from 1-10.
- c. Compute and enter the total points for all the group members for each category and make sure the average score for each category is 5.
- d. Compute the total number of points given to each member of the group and enter them in the TOTAL POINTS column.
- e. Fold the form in half, staple closed and write your name and your group number on the outside of the paper.

CATEGORY	1	2	3	4	5	TOTAL POINTS
LAST NAMES IN ALPHABETICAL ORDER						
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
TOTAL						

CATEGORIES:

1. FOLLOWED THROUGH ON COMMITMENTS AND RESPONSIBILITIES
2. WAS EFFECTIVE IN COMMUNICATING WITH OTHERS – WRITTEN AND ORAL
3. TOOK INITIATIVE BUT ALSO ALLOWED OTHERS TO CONTRIBUTE
4. WAS WILLING TO SHARE THE WORKLOAD AND ASSIST OTHERS WHEN NEEDED
5. PROVIDED HIGH QUALITY WORK

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Project 5 – Design Studio machine tools experience
Project Due Date: As Assigned (No later than Dec. 2, 2010)

This project will give you the opportunity to develop or expand upon your experience with the safe operation of selected machine tools by machining a part to specifications called out on an engineering drawing.

Project Description:

The goal is to learn how to properly operate selected equipment in the AME Design Studio (Rm. B-19 Fitzpatrick) and gain some first-hand machining experience. To begin the project you will be provided with a safety briefing to outline important issues related to the safe operation of the equipment. During this session you will also see a demonstration of how to machine a part on either the lathe or the vertical mill and how to use measuring devices to check the part as you machine it to the specifications.

This project will be done individually and the studio sessions will be scheduled on a staggered basis through the entire semester beginning approximately Sept. 1. The TAs will explain how to use the equipment and the steps required for each task but you will perform all the necessary steps to actually machine the part during your Machining Session.

Project Requirements:

To receive credit for completing this project, you will be required to prepare for and attend two sessions in the AME Design Studio, B-19 Fitzpatrick Hall. The project involves the following:

- a. You are required to read the Machine Shop Safety guidelines posted on Concourse before the first session, Safety Training and Demonstration. The safety guidelines must be followed at all times while in the Design Studio as they are in place to prevent harm to you and those around you. Failure to do so will disqualify you from completing and receiving credit for this project.
- b. You are required to attend a Safety Training and Demonstration session in B-19. These sessions will be scheduled during the semester and you will be notified as to which session you should attend. This session should take approximately 1 hour.
- c. Shortly after the Safety Training and Demonstration you will be scheduled for a second, Machining Session in B-19. Prior to this session you will be provided with information on the machine you will be using (vertical mill or the lathe) and a detailed part drawing. You should review the part drawing and machining instructions prior to your Machining Session and come to the session prepared to machine the part. You will have approximately 1 hour to work with the machine under the supervision of a TA to complete your part. Depending upon your experience and demonstrated skill, you may have the opportunity to add other features to your part or explore other features of the machine tools. Upon completion of your Machining Session the TA will make a determination whether you adequately understand how to safely operate the equipment and certify you for use of this machine in the Senior Design Project course.

You will be contacted by email notifying you of the Safety Training and Demonstration to which you've been assigned. You will then work with the TAs to determine a time for your Machining Session. You must complete your Machining Session in the week you are assigned to receive credit for this project. If you have a conflict during the week you are assigned, contact the project TA coordinators as soon as possible.

Project TA Coordinators:

Juan Camilo Medina
Matthew Mosby

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Homework #1

Due Date: Tuesday, Sept. 7, 2010

This homework assignment is associated with Project 3, Design Study, which involves the conceptual development of a mechanical device to assist a person with a temporary or permanent physical disability. The first design method that will be applied to the project will involve the use of the visual thinking method referred to as concept or mind mapping to assist in the problem formulation. Homework #1 involves developing 2 concept maps. You can develop the maps using pencil and paper or computer software of your choice. You do not need to explicitly state the relationship between the nodes on the graph unless it helps you clarify your thinking. Keep in mind that others will be reviewing your work so if you submit handwritten maps, try to print legibly.

- a. The first concept map is intended to help you explore the basic question and should begin with the central node “physical disability.” The purpose of this map is to express the kinds of physical challenges or remediation opportunities that might be addressed in this project.
- b. Once the first map is completed, **select a node from the first map** that represents a specific physical challenge or remediation opportunity and expand a second map to express your thoughts related to issues associated with that specific issue. The purpose is to explore the issues associated with this challenge or opportunity NOT to propose specific design solutions – that comes later!

Additional Homework Guidelines:

These concept maps will be the first elements in the Project 3 – Design Study portfolio. As will be the case with all the homework assignments that will be parts of the Project 3 portfolio, you will receive comments on the submission from one of your peers. The **Critique and Recommendation Form** will be part of your homework submission for this and future homework assignments. Please follow these steps when submitting your homework in this course:

1. Complete your assignment. Note that all homework submissions should follow the guidelines of the University Academic Code of Honor. Collaborative efforts or outside information sources should be appropriately cited on the homework submission.
2. Print a blank copy of the **Critique and Recommendation Form**.
3. Legibly print the homework assignment number, date and your name on the Form.
4. Use the **Critique and Recommendation Form** as the first page of your submission and please staple the entire submission together and bring it to class on the due date.
5. Time will be set aside during the class period when the submission is due for students to exchange assignments and provide reviews prior to the submission of the homework. Different procedures will be used to assign the reviewers and those will be announced in class. The homework and the review will be submitted as a single package after the review has been completed in class.
6. The reviewer should annotate comments on the submission itself when the comments would help in the critique but please do so using another color ink, pencil, etc. so one can discriminate reviewer comments from original content. The reviewer will also print their name and write their initials on the critique.
7. **If you miss class when a submission is due and still what to submit the homework, it will be your responsibility to work with a classmate to provide a review prior to submitting a late homework assignment. A homework assignment is considered as incomplete unless it is submitted with a review and submitting a review is also part of each homework assignment.**

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Critique and Recommendation Form:

Homework assignment number: _____ Submission Date: _____

Homework submitted by: _____

Did the submission satisfy the basic requirements? If not, what is missing?

What elements or features of the submission did you find to be most effectively communicated?

What recommendations would you provide to improve the submission?

Reviewer: _____
(printed name and initials)

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Homework 2 – Design Brief
Due Date: Tuesday, Sept. 14, 2010

This homework assignment supports your work on Project 3, Design Study. Project 3 involves the conceptual development of a mechanical device to assist a person with a temporary or permanent physical disability.

Design involves the co-evolution of the problem and its solution, but you need to begin somewhere and this assignment involves the preliminary steps in the development of the design challenge or problem. This is sometimes referred to as a the “design brief.” For this assignment you will prepare an abbreviated version of a design brief as it will not contain information like a schedule, budget, deliverables, personnel but it will focus on the statement of the design challenge. For this assignment you are tasked with selecting a specific temporary or permanent physical disability and human activity that you want to assist with your mechanical device. This assignment is NOT about the design of device but is intended to help you begin to understand and describe the design challenge. The assignment requires:

- a. A single paragraph (no more than 200 words) that describes the disability and the human activity that you are going to address.
- b. A single paragraph (no more than 200 words) that describes your inspiration for your selection of this activity.
- c. A list of 5 potential sources of information to assist you in exploring this design challenge.
- d. A single “slide” that you could use to present your design challenge to a potential investor.

All of these items should be submitted on two sheets of paper.

(The Design Brief will be included in the Project 3 – Design Study portfolio. Please see the **Additional Homework Guidelines** on Homework 1 for submissions instructions for this assignment.)

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Critique and Recommendation Form:

Homework assignment number: _____ Submission Date: _____

Homework submitted by: _____

Did the submission satisfy the basic requirements? If not what is missing?

What elements or features of the submission did you find to be most effectively communicated?

What recommendations would you provide to improve the submission?

Reviewer: _____
(printed name and initials)

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Homework 3 – Understanding your customer
Due Date: Thursday, Sept. 23, 2010

This homework assignment supports your work on Project 3, Design Study. Project 3 involves the conceptual development of a mechanical device to assist a person with a temporary or permanent physical disability.

A key step in the design process is developing an accurate and in-depth understanding of your customer/s. This assignment focuses on that step. You are still in the **problem formulation** stage and at this point you have identified the need/opportunity that you want to address but now you want to understand your customer's perspective on this problem. To accomplish this you are going to employ two approaches, Observe and Immerse. For each approach you will need to plan an information gathering strategy, collect the information, digest it and present it.

This assignment requires that you apply both of the following methods to study the behavior of **non-physical-disability-limited** people performing the activity you are addressing in Project 3 in order to develop insights into key aspects of the activity that might influence your design thinking as you develop your concept.

1. Observe:

- a. Observe people performing the activity and select a method to collect **specific information** regarding their behavior.
- b. Observe, collect and record the information.
- c. Evaluate the information and develop a list of **3 key insights**, gained from your observations, that you believe will enable a better understanding of the issues faced by a person with the disability performing the activity.

2. Immerse:

- a. Perform the activity yourself and select a method to collect **specific information** regarding your experience.
- b. Collect and record the information associated with your experience.
- c. Evaluate the information and develop a list of **3 key insights** gained from your immersion in the activity that you believe will enable a better understanding of the issues faced by a person with the disability performing the activity.

Each of the two studies you performed should be presented on their own single sheet of paper. One study should be presented as a one-page memorandum. This should be a text-only document (it can include numbers or a table, use no smaller than 11 pt font, single space, 1 inch margins) and you can select an appropriate memorandum format. The second study should be presented as a single, "STAND ALONE" slide appropriate for projection at a client meeting. The slide can contain words, numbers, visuals, etc. You can select which presentation format to use for each study – but you need to use both formats.

(Homework 4 – Understanding your customer - will be included in the Project 3 – Design Study portfolio. Please see the **Additional Homework Guidelines** on Homework 1 for submissions instructions for this assignment.)

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Critique and Recommendation Form:

Homework assignment number: _____

Submission Date: _____

Homework submitted by: _____

Did the submission satisfy the basic requirements? If not what is missing?

What elements or features of the submission did you find to be most effectively communicated?

What recommendations would you provide to improve the submission?

Reviewer: _____
(printed name and initials)

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Homework 4 – Activity diagram
Due Date: Tuesday, Sept. 28, 2010

This homework assignment supports your work on Project 3, Design Study. Project 3 involves the conceptual development of a mechanical device to assist a person with a temporary or permanent physical disability.

This assignment represents another step in the **problem formulation** phase of the design process. During this phase you are working to develop a better understanding of the need/opportunity that you want to address and continuing to develop an understanding of your customer's challenges.

This assignment requires that you apply your learning to date and **develop an activity diagram to explicitly represent your understanding of how a physically disabled person will interact with the device you will design** and their environment. The diagram should attempt to include as many interactions with and tasks to be performed as you can imagine. The activity diagram will assist you as you begin to envision the functional structure of your concept in preparation for developing design requirements.

The activity diagram should be presented on a single sheet of paper. This single sheet of paper should be titled with a concise statement of the disability and activity you are addressing (limited to 10 words), your name and this single sheet of paper should be a "STAND ALONE" document appropriate for presentation at a client meeting.

(Homework 4 – Activity Diagram - will be included in the Project 3 – Design Study portfolio. Please see the **Additional Homework Guidelines** on Homework 1 for submissions instructions for this assignment.)

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Critique and Recommendation Form:

Homework assignment number: _____

Submission Date: _____

Homework submitted by: _____

Did the submission satisfy the basic requirements? If not what is missing?

What elements or features of the submission did you find to be most effectively communicated?

What recommendations would you provide to improve the submission?

Reviewer: _____
(printed name and initials)

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AME30362: Design Methodology, Fall 2010

Homework 5 – Function structure diagram
Due Date: Tuesday, Oct. 5, 2010

This homework assignment contributes to your work on Project 3, Design Study. Project 3 involves the conceptual development of a mechanical device to assist a person with a temporary or permanent physical limitation or disability.

This assignment represents one of the last steps in the **problem formulation** phase of the design process. The design method you will apply is intended to assist in the process of converting your understanding of your customers' needs into an expression of the required functional capabilities for your product.

This assignment requires that you **develop a function structure diagram** to explicitly represent your understanding of how a physically limited/disabled person will interact with the device you will design and their environment. It is fully appreciated that this is a difficult task and that at this point your experience with this methodology is limited. Thus you are asked to apply this methodology in the following steps:

1. Develop a sketch of the main function of the product in the “black box” form and indicate the primary energy, material and information flows (both input and output).
2. Begin the more detailed development of the diagram by then working to describe the main function in terms of a consistent set of subfunctions, connecting the primary inputs to the outputs. Develop two iterations for this diagram, the second, which is referred to below as the FINAL, building upon the first. Please note that: 1) this process would most likely require many more iterations, 2) there is no single correct answer and 3) you are NOT DESIGNING your product (you will give it form later in the project) but are attempting to gain a deeper understanding of its function.

It is recommended that you use the top two figures in Figure 7.2, page 197, from the Roozenburg reference as examples of the level of detail and presentation format for this assignment.

The FINAL function structure diagram should be presented on a single sheet of paper – in landscape mode. This single sheet of paper should be titled with a concise statement of the activity and the limitation/disability you are addressing (limited to 10 words) and your name. This single sheet of paper should be a “STAND ALONE” document appropriate for presentation to colleagues to discuss the development of your ideas.

Submit this assignment by stapling together the following 4 sheets of paper:

- FIRST PAGE - your **Critique and Recommendation Form** cover sheet
- SECOND PAGE – your FINAL function structure diagram
- THIRD PAGE – your “black box” form of the diagram
- FOURTH PAGE – your first iteration of the diagram

(Homework 5 – Function structure diagram - will be included in the Project 3 – Design Study portfolio. Please see the **Additional Homework Guidelines** on Homework 1 for submissions instructions for this assignment.)

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Critique and Recommendation Form:

Homework assignment number: _____ Submission Date: _____

Homework submitted by: _____

Did the submission satisfy the basic requirements? If not what is missing?

What elements or features of the submission did you find to be most effectively communicated?

What recommendations would you provide to improve the submission?

Reviewer: _____
(printed name and initials)

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Homework 6 – Engineering Design Requirements – House of Quality
Due Date: Tuesday, Oct. 12, 2010

This homework assignment contributes to your work on Project 3, which involves the conceptual development of a mechanical device to assist a person with a temporary or permanent physical limitation or disability. This assignment represents the last step in the **problem formulation** phase of the design process. The design method you will apply is intended to assist in the process of converting your customers' needs into quantifiable and measurable design requirements.

You will use selected elements of the House of Quality in order to begin to develop a set of quantified engineering design requirements (target specifications) for your Project 3 concept. You will just be able to take the first steps in developing a complete list of requirements but you want to use this opportunity to see how the HoQ approach can be applied to this part of the design process. It is recommended that you limit the study to:

1. Consider just two customers (Whos) – the physically disabled or limited user of the product AND EITHER a health care professional who would prescribe/fit/monitor the product OR the manufacturer.
2. Identify a total of 8 customer requirements (Whats) – with at least three in each in each of the two areas: Physical Properties, Functionality.
3. In the Who vs. What section. Allocate a total of 50 points to each customer and distribute them between the Whats to indicate the relative importance of each What to each customer.
4. Since you've not had the opportunity to effectively identify benchmark products you'll need to skip the Nows and the Now vs. What sections of the House of Quality for this assignment.
5. Identify 8 Hows – these must be quantifiable parameters and don't forget the units! **This is the KEY step in this assignment.** Hows represent quantifiable, measurable characteristics of your product.
6. In the What vs. How grid use the following notation:
 - ✖ - strong relationship
 - ○ - medium relationship
 - ■ - weak relationship
 - blank - no relationshipto provide your assessment of the correlation between each What and each How.
7. You will have to defer your assessment of How Much until a later study.
8. Finally complete the “roof” on the house using the scale:
 - -9 : strong inverse relationship
 - -3 : weak inverse
 - 0 : neutral
 - 3 : weak positive
 - 9 : strong positive

Your work on this assignment should be professionally presented as single “House of Quality” graphic presented in “landscape” format on a single sheet of 8 ½ x 11 paper. The graphic should include a title for your project (no more than 10 words) and your name.

(Homework 6 – Engineering Design Requirements - will be included in the Project 3 – Design Study portfolio. Please see the **Additional Homework Guidelines** on Homework 1 for submissions instructions for this assignment.)

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Homework 7 – Prototyping for Ideation
Due Date: Tuesday, Oct. 26, 2010

This homework assignment contributes to your work on Project 3, which involves the conceptual development of a mechanical device to assist a person with a temporary or permanent physical limitation or disability. This assignment provides you with the chance to explore the product ideation process using physical prototyping.

Prototyping can be employed during different stages of the design process. Early in the concept development phase it can be used to help you initiate and think through an idea for a concept as a whole or explore some feature of the concept via a physical embodiment. Virtual prototyping or simulation can also be very effective early in the process – but they are not the focus of this homework. At this point fidelity or functionality are not the primary objectives. Ideation prototypes can simply be used to begin to appreciate the relative orientation of primary components, overall size of the design, the general nature of the interface between the user and the product or sometimes you can actually show it to a potential customer and get immediate feedback on an idea!

Ideation prototypes exploit the most readily available, inexpensive and easiest to adapt materials to assist the designer in their thinking. They are NOT INTENDED to provide the answer – but to help you find it. As much can be learned from a prototype that really “doesn’t work,” or exposes a flaw in your idea, as one that does. The key to this method is being able to **process the information gained from your experience** with the prototype and to use it to inform subsequent design decisions.

For this assignment you are tasked with developing an ideation prototype for some feature, element, aspect, etc. of your design concept. You should use readily available materials. There is no need to purchase ANYTHING in order to complete this assignment. Fabricate with the materials as many prototypes as you wish/need, document them but, most importantly carefully record the insights – positive and negative – that you gained during the process. Please note this assignment does not intend for you to fabricate something that embodies your entire concept or that it functions in any way. It also recognizes that your concept is just beginning to evolve so your concept at the end of this assignment may be different than at the beginning.

Your work on this assignment should be professionally presented as:

- 1) A single slide presented in “landscape” format on a sheet of 8 ½ x 11 paper that shows the prototype/s, an visual indication of how it was evaluated and concise statements of 2 key insights gained from its development.
- 2) A single sheet of paper that briefly describes:
 - a. Primary purpose for the prototype
 - b. A list of all the materials used to fabricate the prototype
 - c. A brief list of “all” the insights gained – not just the two that appear on the slide.

(Homework 7 – Prototyping for Ideation - will be included in the Project 3 – Design Study portfolio. Please see the **Additional Homework Guidelines** on Homework 1 for submissions instructions for this assignment.)

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Homework submitted by: _____

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Homework 8 – Preliminary Design Concept
Due Date: Tuesday, Nov. 2, 2010

This homework assignment is the last of the assignments that will be included in Project 3, which involves the conceptual development of a mechanical device to assist a person with a temporary or permanent physical limitation or disability. This assignment provides you with the chance to represent visually the current status of your design concept.

Throughout the semester you have worked to develop an understanding of a need, your customer and the “wants” of the customer in order to develop a set of objectives for your design development activities. Now you have the chance to visually express your design concept – in its earliest stages. Obviously you can provide only limited details on any specific feature of the design, and you have not had the opportunity to perform the required critical evaluation of the design – but **you need to start somewhere**, and the information you provide with this assignment would represent a starting point for the next phase of the design process.

You are tasked with visually representing your design concept in the form of sketches of the entire product, key components, cutaways, etc. – NOT words. These are the kinds of representations you might use to begin to describe your concept to a colleague, supervisor, potential customer or investor.

Your work on this assignment should be professionally presented as three slides in “landscape” format on 8½ x 11 paper. The content on the slides should be almost exclusively “drawings.” Limited labeling is acceptable but you should **limit individual labels to NO MORE 3** words and only use the labels to identify elements or components. These three slides can and probably should be hand-drawn though computer generated visuals are acceptable as well. A mix of hand drawn and computer-generated drawings is also permitted.

It is **STRESSED** that artistic skill is not a prerequisite for this assignment. You are attempting to express form and functionality in as **simple and effective** a manner as you can with the drawing skills you possess. Your goal is to be able to express your ideas for the concept in a way that someone “gets it.” So multiple views in various modes of operation would be useful. From these slides one should be able to begin to understand the concept, how it might function and how it might be used.

The slides should not contain your name or a title – just the graphics and labels. You should write your name on the backside of each slide.

(Homework 8 – Preliminary Design Concept - will be included in the Project 3 – Design Study portfolio. Please see the **Additional Homework Guidelines** on Homework 1 for submissions instructions for this assignment.)

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Homework 9 – Engineering Parametric Trade Study - Formulation
Due Date: Tuesday, Nov. 9, 2010

Parametric trade studies provide a framework for the designer to perform quantified, “what-if” studies. Formulating an effective engineering parametric trade study is the first step in applying this important design method.

In this assignment you will develop a plan for a trade study for the preliminary design of an electric-powered vehicle. This vehicle may have multiple functions but your **initial concern is its ability to push a load at constant speed across a flat surface**. You will use your trade study to begin to understand important characteristics of this system and help quantify specific concept details. A handout describing a simple model for the vehicle and motor is posted on Concourse. To help formulate your study assume: 1) you will use the electric motor presented in the handout but you can modify the gear ratio, 2) the surface is concrete, 3) the pushed-loads are wood blocks weighing up to 15 lbs, 4) you want to push the loads at speeds up to 10 ft/sec.

To complete the assignment you will have options in selecting the most appropriate analysis tool. You can: 1) perform the required calculations by hand (it is a rather simple system), 2) use/modify a “legacy” analysis code in the form of an Excel spreadsheet (posted on Concourse), or 3) develop your own software to perform the required calculations.

In Homework 9 you are asked to develop a parametric trade study **proposal** in preparation for the actual trade study that will be conducted for Homework 10. You should try to address what you believe to be important design questions but for this preliminary study you should consider just **three design variables**. It is recommended that you read the Homework 10 assignment prior to preparing your proposal.

The proposal is a one-page-maximum, typed (12 pt font) **engineering memo** with a single page “attachment.” The memo should explicitly include:

1. A concise statement of the purpose of the study. What information do you intend to develop?
2. A readily identifiable list of:
 - a. three (3) design variables you will vary for this study (names/units NOT values)
 - b. key behavior (state) variables you will determine for this study (names/units NOT values)
 - c. necessary design parameters you will assume for this study (names/units NOT values)
3. A brief description of the approach to be used to generate the information required for the study. Which one of the three “tools” listed above do you intend to use and how you intend to apply it?
4. A list of the assumptions you made in formulating your study.
5. Decisions that you expect the study would influence.
6. Description of how you plan to present the information determined by the study (e.g. plot of x vs. y, table of x,y,x, list of w and z, etc.)

The attachment should be a single page sample calculation that demonstrates that you have developed/used the “tool” you plan on applying in your study.

This homework assignment is NOT part of Project 3 but you will have the opportunity to review the proposal of one of your classmates and receive comments on your proposal. Please staple a copy of the following page to the form to the front of your proposal and attachment and write your name and submission date on the form.