

Course syllabus

Spring Semester 2010

Department of Industrial Technology
University of Northern Iowa
Cedar Falls, IA 50614--0178

330:135g Product Design

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Course web page: www.uni.edu/~rao/Course6.htm

OFFICE HOURS: W 8:00 am - 12:00 p.m. or by appointment

COURSE DESCRIPTION: Design Process, Designers and Design Teams, Project Definition and Planning, Development of Engineering Specifications, Concept Generation, Concept Evaluation, The Product Design Phase, Product Generation, Evaluation for Performance and the Effects of Variation, Evaluation for Cost, Manufacture, Assembly, and other Measures, Launching and Supporting the Product Prerequisite: 330:148g.

COURSE TEXTBOOK:

Required: David G. Ullman (2010), The Mechanical Design Process, Fourth Edition, ISBN: 0-07-297574-1, 433 pages.

Optional:

Karl Ulrich, and Steven Eppinger, Product Design and Development, McGraw Hill, Fourth Edition, ISBN-13 9780073101422, 2008, 384 pages

Barry Hyman, Fundamentals of Engineering Design, Second edition, Prentice Hall, 2003, ISBN 0-13-046712-X

Kevin Otto and Kristin Wood, Product Design – Techniques in Reverse Engineering and New Product Development, Prentice Hall, New Jersey, 2001, ISBN 0-13-021271-7

CLASS SCHEDULE: W 5.00 p.m. to 7.50 p.m. Room 24, ITC

COURSE GOALS:

To provide the student with the practical experience in designing products
To provide students with the ability to use the various industrial components in their design
Allow students to make use of the various courses learned in the design

COURSE OBJECTIVES:

By the end of this course, students should be able to

- To learn about the process of design in order to generate better quality designs in less time.
- To learn about the organization of design within a company.

- To learn how to be more creative in solving design problems.
- To learn how to design as part of a group activity.

COURSE ORGANIZATION:

Design Project: As part of the course, students will be doing a complete design project as a group. We will go through the entire motions similar to an actual industrial design project. Ideally the project should consist of at least 15 parts but not more than 20 parts, to give sufficient design experience without over loading. The product can be an entirely new idea or an improvement over the existing product. This will be done by a team of students. Ideally the team should be 3 to 4 students for the above type of product design. Use the Company Procedure Bulletin for details.

Individual Design Notebooks: You are to keep a design notebook for use in this course. This is to be a spiral bound notebook such as National 33-610 which has graph paper on the back of each lined sheet. All work concerning the design project will be entered into this notebook. This includes all sketches, notes, design ideas and homework. The homework you turn at the specified periods must be a photocopy of that in the design notebook. Every page in the notebook must be numbered at the beginning of the term. No pages can be removed and each page must be dated and initialed when used. In other words, everything you do on the project is included in the notebook. Each notebook will be collected at the end of the term and graded on the number of "quality entries" it contains. A quality entry is a significant sketch or drawing of some aspect of the design; a listing of functions, ideas, or other features; a table such as morphology or decision matrix; or a page of text. Entries that are unintelligible are not "quality entries". The grading will be:

- grade of 100% for 50 or more quality entries
- grade of 90% for 40-49
- grade of 80% for 30-39
- grade of 70% for 20-29
- grade of 60% for <20

Product Development Report: This is a group produced file covering the history of the design. Documents that should be in the Product Development File are:

Problem Appraisal Phase

Understanding the Problem

1. Description of Customers
2. Customer's Requirements
3. Weighting of Customer's Requirements
4. Competition's Benchmarks Versus Customer's Requirements
5. Engineering Requirements
6. Competition's Benchmarks Versus Engineering Requirements
7. Engineering Targets

Planning the Project

8. Task Titles
9. Objectives of each Task

10. Personnel Required for Each Task
11. Time Required for Each Task
12. Schedule of Tasks

Conceptual Design Phase

Concept Generation

13. Functional Decomposition
14. Literature and Patent Search Process and Results
15. Function-Concept Mapping
16. Sketches of Overall Concepts

Concept Evaluation

Assessment of Technology Readiness

17. Identification of Failure Modes
18. Identification of Critical Parameters

Concept Selection

19. Decision Matrices to Determine Best Concepts
20. Analysis, Experiments and Models Supporting Evaluation

Product Design Phase

Product Generation

21. Usable Off-the-Shelf Products
22. Shape Development Driven by Function
23. Material(s) Selection
24. Manufacturing Process(s) Selection

Product Evaluation

25. Comparison to Engineering Requirements
26. Functional Changes Noted
27. Design for Assembly Evaluation
28. Cost Evaluation
29. Analysis, Experiments and Models Supporting Evaluation

Final Product Documentation

30. Layout Drawings
31. Detail Drawings of Manufactured Parts
32. Parts List (Bill of Materials)
33. Assembly Instructions
34. Product brochure

All the material need to be word processed and computer generated arranging in a neat format. The file is to be maintained by the group in a binder. This file, when completed, and properly organized, is effectively a final report. It will be graded on completeness and quality of both the design and the documentation itself.

Note: To make grading of the group fair, the group grades will be corrected for each student with a weighting factor. This factor will be developed by each group member's confidential evaluation of all members in the group. Each member of the group will evaluate every member of the group (including themselves) for the percent of his/her contribution to the project. The evaluations will be averaged by Professor to find each student's contribution and the weighting factor made proportional to it. If there are, for example, three students in a group and each makes the same

(33%) contribution then all will get the same grade. However, if one makes a 40% contribution, one a 25% contribution and the third a 35% contribution then the grades will be corrected by the difference from 33%. Thus, if the group grade was 85% then the first student would get 92% ($85+(40-33)$), the second would get 77% ($85+(25-33)$) and the third 87%.

Observed Performance

At the end of the term the instructor will assign each student a grade based on observed performance. It includes such factors as facility of working within the group, problem solving ability, initiative, attitude, attendance, and punctuality.

Attendance:

Attendance is required in all scheduled lecture and laboratory meetings.

Final Examination: This will be a short answer exam covering the terminology and concepts studied throughout this course.

Statement on Cheating

When under the pressure of deadlines, some students may be tempted to copy another student's drawing and hand it in as their own. Before yielding to such temptation, the student should be aware that (1) the University's policy statement on academic ethics permits expulsion for such an offense (2) that I would consider failure for the course a more appropriate punishment.

Submissions and Presentations

Date	Description	Submission
Feb. 10	Presentation and submission of the initial research on the product. A power point presentation by the group	A small report describing the presentation and a summary of Items 1 – 7. Individual
Feb. 24	Submission (Items 8 – 12)	Photocopies of the pages from the Design Notebook concerning Items 8 – 12. Individual
Mar. 10	Submission (Items 13 – 16)	Photocopies of the pages from the Design Notebook concerning Items 13 – 16.
Mar. 24	Presentation and submission of the initial concept on the product. A power point presentation by the group	A small report describing the presentation and a summary of Items 17 – 20. By group
Apr. 7	Submission (Items 21 – 24)	Photocopies of the pages from the Design Notebook concerning Items 21 – 24. Individual
Apr. 21	Submission (Items 25 – 29)	Photocopies of the pages from the Design Notebook concerning Items 25 – 29. Individual
Apr. 28	Final comprehensive presentation. A power point presentation by the group	Submission of Final Product Development File by group

GRADING SCALE:

Grades will be determined by assigning the following weighing to each area:

Attendance, observed performance, attitude, etc.	10%
Desk set project concept	10%
Initial research presentation	10%
Concept presentation	10%
Design project final presentation	10%
Design project final report	10%
Assignments	5%
Design notebooks	20%
Final examination	15%

Percentage range	Grade	Percentage range	Grade
95 – 100	A	74 – 76	C
90 – 94	A-	70 – 73	C-
87 – 89	B+	67 – 69	D+
84 – 86	B	64 – 66	D
80 – 83	B-	60 – 63	D-
77 – 79	C+	< 60	F

Disabilities Act

The Americans with Disabilities Act of 1990 (ADA) provides protection from discrimination for qualified individuals with disabilities. Students with a disability, who require assistance, will need to contact the office of Disability Services (ODS) for coordination of academic accommodations. The ODS is located at 213 Student Services Center. Their phone number is (319) 273- 2676.

Research Paper (Graduate students only): Graduate students registered for this course need to complete additional work as part of the department policy. Contact the instructor within the first week to get the additional work allocation. They are expected to do a detailed study of a topic relevant to the course content, subject to the approval of the instructor. The topic and a brief written description are to be submitted to the instructor by February, 3rd. The type written, 8 to 12 page APA format paper is to be submitted by April 28th.

TENTATIVE SCHEDULE OF LEARNING ACTIVITIES

Week	Date	Topics	Textbook
1	1/13	Introduction to the course Mechanical design process Desk Set Design project details	Chapter 1 Chapter 2
2	1/20	Designers and design team Design process Submit Desk Set project Identification of the projects and groups	Chapter 3 Chapter 4
3	1/27	Project definition and planning Understanding the problem and the development of engineering specification	Chapter 5 Chapter 6
4	2/3	Presentation and submission of the initial research on the product (Items 1 – 7) Concept generation	Chapter 7
5	2/10	Concept evaluation	Chapter 8
6	2/17	Submission (Items 8 – 12) The product design phase	Chapter 9
7	2/24	Product generation Design project	Chapter 10
8	3/3	Product evaluation for performance and the effect of variation Design project	Chapter 11
9	3/10	Product evaluation for cost, manufacture, assembly and other measures Submission (Items 13 – 16) Design project	Chapter 12
10	3/24	Presentation and submission of the initial concept on the product (Items 17 – 20) Launching and supporting the product Design project	Chapter 13
11	3/31	Design project	
12	4/7	Design project Submission (Items 21 – 24)	
13	4/14	Design project Design project	
14	4/21	Design project Submission (Items 25 – 29)	
15	4/28	Final presentation Submission Final Product Development File	
16	5/5	Final examination - 5.00 to 6.50 pm	