School of Engineering

University of Alaska Anchorage

Senior Design Course Manual

for the

Bachelor of Science in Engineering Program

May 2009

This manual provides guidelines for the senior design courses and is intended to provide structure and useful information. The procedures were developed through a lengthy process of examining other successful senior design programs throughout the country and designing to meet the specific needs of Alaska industry and students.

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Note: Additional, guidelines, reference material, forms, important events, etc. are also provided through the Senior Design Course website accessible on the main BSE program site at:

http://www.engr.uaa.alaska.edu/programs/bse/index.cfm

Course Content Guides and Syllabi

The following course content guides provide the basic course material, course prerequisites, instructor goals, student outcomes, and ABET Course Outcomes for the senior design courses.

CSE 438 Course Content Guide

UNIVERSITY OF ALASKA ANCHORAGE
SCHOOL OF ENGINEERING
COURSE CONTENT GUIDE

CSE A438 Design of Computer Engineering Systems

Department: Bachelor of Science in Engineering (BSE) **Date**: 10/27/08

Course Prefix, Number, and Title: CSE A438 Design of Computer Engineering Systems

I. Course Description
Capstone course in which computer systems engineering students design a computer component or system starting with the initial design specification to the implementation and testing. Students apply knowledge and skills learned in their undergraduate curriculum.

II. **Course Design**

A. **Fundamental intent**: Provide computer systems engineering undergraduate students with a capstone design experience and present information important to employment and success as a professional engineer in practice.

B. **Number of Semester Credits**: Three (3)

C. **Course schedule**: Standard semester timeframe.

D. **Lecture hours/week**: Three (3)

E. **Laboratory hours/week**: N/A

F. **Total time of work expected outside of class**: Five (5) to eight (8) hours per week.

G. **Programs that require this course**: Bachelor of Science in Engineering with specialization in Computer Systems Engineering

H. **Grading**: A-F

I. **Coordination with affected units**: UAA faculty list-serve

J. **Justification for action**: This course requires approval as the General Education Requirement capstone course for the Bachelor of Science in Engineering degree program with Computer Systems Engineering specialization.

K. **Prerequisite**: N/A

L. **Registration Restrictions**: Student must be in senior year of BSE degree program or obtain faculty permission. Completion of GER TIER 1 (Basic College-level skills) courses.

III. Course level justification

Students are required to apply knowledge from courses completed in the 3rd year of the Bachelor of Science in Engineering degree program with Computer Systems Engineering specialization.

IV. Course Outline

A. Introduction and Project Determination
B. Job hunting skills
C. Team concepts and team building
D. Design drawing formats as needed for computer systems engineering practice and design
E. Specification writing formats as needed for computer systems engineering practice and design
F. Design codes and regulations as required for computer systems engineering practice and design
G. Project management
H. Safety or security considerations in computer systems engineering design
I. Legal considerations in computer systems engineering design
J. Professional registration and the business of computer systems engineering
K. Professional engineering volunteer organizations
L. Engineering ethics
M. Public presentation
N. Project Implementation
O. Project Testing
P. Self-Evaluation
Q. Peer Evaluation
R. Presentation and Faculty Evaluation

V. Instructional Goals and Student Outcomes

A. Instructional Goals. The instructor will:
   1. Enable students to understand and apply concepts, principles, and skills learned in the undergraduate engineering curriculum, and
   2. Prepare senior computer systems engineering students for professional practice.

B. Student Outcomes and Assessment Methods

CSE A438 Student Learning Outcomes and Corresponding Methods of Assessment	
Outcome: Students will	**Method of Assessment**
1. Identify problems and opportunities, develop related engineering design criteria, and formulate alternative solutions to meet project specifications while protecting applicable public health, safety, or security concerns	Faculty and other applicable evaluations of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports.
2. Apply knowledge and skills learned in the computer systems engineering undergraduate curriculum including the ability to	Faculty evaluations of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical
3. Function effectively on multi-disciplinary teams to collaborate on iterative design of a complex computer systems engineering system with conflicting technical, social, economic, and aesthetic objectives	Faculty evaluation of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports. Peer evaluations of team performance.
4. Demonstrate professional, legal, and ethical responsibilities of practicing computer systems engineers	Faculty evaluation of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings,
5. Demonstrate ability to engage in life-long learning in the context of computer systems engineering professional practice	Faculty evaluation of work products with emphasis on evidence of self initiated learning of principles not covered in the curriculum to obtain needed information to solve the design problem.
6. Communicate effectively with engineering drawings and technical visualizations, design specifications, written technical reports, and public oral presentations	Faculty evaluation of interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports

VI. **Course Activities**: Students work together in teams to design a computer systems engineering devices or systems to meet the project specifications. In addition to the project, weekly lectures cover general topics of concern to practicing engineers. See the Section IV for a typical course outline. Half of the lecture time is spent covering the listed topics. The remaining time is spent in a "staff meeting" to discuss projects and their progress.

VII. **Course Evaluation:** No exams are given in this course. Grades are based on individual and group performance relative to the assigned project. The instructor(s) are to implement a performance assessment process that is similar to that which would be used for employee performance evaluation in a commercial or agency engineering office that consists of faculty and other applicable evaluations of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports.

VIII. **Capstone Requirement Justification**

This course satisfies all of the criteria for a capstone course including the following:

a. *Knowledge integration is incorporated as part of the course design,*
b. *Knowledge integration is specifically addressed as part of outcomes assessment,*
c. *Four instructional goals and student outcomes are part of the course design including,*
    i. *Effective communication*
    ii. *Critical thinking*
    iii. *Informational literacy*
    iv. *Quantitative perspectives*
d. *Performance in Knowledge Integration and instructional goals and student outcomes are assessed,*
e. *Student artifacts are generated that demonstrate achievement of student outcomes.*

Teams of students design complex computer components or systems under the scrutiny of faculty and other appropriate reviewers that may include a client or project sponsor. This experience integrates knowledge at multiple levels. The design project is chosen that is multidisciplinary in nature meaning that it will incorporate knowledge from the whole BSE curriculum experienced prior to the senior year. Application of scientific principles and advanced engineering computations are required, using computer software and other tools common to current professional engineering practice.

Assessments are conducted in a manner that is essentially equivalent to performance evaluations in the engineering workplace, as conducted by commercial enterprises and public agencies that employ engineers.

Verbal, written, and graphical technical communication at an advanced level, often involving commercially competitive software, is intensely exercised from beginning to end of the course. Inevitable conflicts among design criteria, implementation conditions, and social and economic constraints require critical review and decision-making by the students in the course. Detailed data and related design parameters must be acquired by students in the course from public sources.

Individual students and each specialty team produce a written report with accompanying digital products that is completely professional in appearance, depth of inquiry, technical detail, and excellence of narrative, tabulations, and graphical presentation.

IX. **Suggested Text:** Students will use a variety of reference material, codes and regulations that are applicable to the project of the year.

http://www.acm.org/. The world's largest educational and scientific computing society, delivers resources that advance computing as a science and a profession. ACM provides the computing field's premier Digital Library and serves its members and the computing profession with leading-edge publications, conferences, and career resources.

X. Bibliography and Resources

Students will use a variety of reference material that is applicable to their projects.

http://www.ieee.org/portal/site

Homepage of the Institute of Electronic and Computer systems Engineers. It includes information on certification, publications, codes, standards and membership information.

http://www.theiet.org

Institution of Engineering and Technology website provides information on publications, news and an online interactive journal, The Computer Forum.

http://www.spie.org

Society of Photo-Optical Instrumentation Engineers website includes society news and information as well as an e-newsletter, OE Reports.

http://www.computer.org/

Online catalog of the Computer Society of IEEE. The site describes publications related to software engineering and information technology.

http://www.intute.ac.uk/sciences/computing/

Science, Engineering and Technology-Computing Gateway of engineering materials which can be searched or used as a directory. Each website is carefully selected with summaries and very few broken links.

http://sunsite.berkeley.edu/NCSTRL/

Networked Computer Science Technical Reference Library "NCSTRL is an international collection of computer science technical reports from CS departments and industrial and government research laboratories, made available for non-commercial and educational use."

http://www.netlib.org/

The Netlib repository contains freely available software, documents, and databases of interest to the numerical, scientific computing, and other communities. The repository

is maintained by AT&T Bell Laboratories, the University of Tennessee and Oak Ridge National Laboratory, and by colleagues world-wide.

http://www.csse.monash.edu.au/mirrors/bibliography/
Collection of Computer Science Bibliographies currently contains 1.4 million references (mostly journal articles, conference papers and technical reports), clustered in about 1400 bibliographies.

http://www.library.cmu.edu/Research/EngineeringAndSciences/CS+ECE/subjects.html
Carnegie Mellon University Library contains an alphabetical list of websites about all aspects of Computer Engineering.

http://www.computer.org/portal/site/seportal/
Software Engineering Online website from IEEE Computer Society is a source of practical software engineering knowledge.

XI. Relationship of Course to Program Outcomes

This course relates to the following Program Outcomes:

a. an ability to apply knowledge of mathematics, science and engineering

b. an ability to design and conduct experiments, as well as to analyze and interpret data

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d. an ability to function on multi-disciplinary teams

e. an ability to identify, formulate and solve engineering problems

f. an understanding of professional and ethical responsibility

g. an ability to communicate effectively

h. the broad education necessary to understand the impact of engineering solutions in a global, economic and societal context

i. a recognition of the need for, and an ability to engage in life-long learning

j. a knowledge of contemporary issues

k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

UNIVERSITY OF ALASKA ANCHORAGE
SCHOOL OF ENGINEERING
COURSE CONTENT GUIDE

EE A438 Design of Electrical Engineering Systems

Department: Bachelor of Science in Engineering (BSE) **Date**: 10/27/08

Course Prefix, Number, and Title: EE A438 Design of Electrical Engineering Systems

I. Course Description
Capstone course in which electrical engineering students design a electrical engineering component or system starting with the initial design specification to the implementation and testing. Students apply knowledge and skills learned in their undergraduate curriculum.

II. **Course Design**

A. **Fundamental intent**: Provide electrical engineering undergraduate students with a capstone design experience and present information important to employment and success as a professional engineer in practice.

B. **Number of Semester Credits**: Three (3)

C. **Course schedule**: Standard semester timeframe.

D. **Lecture hours/week**: Three (3)

E. **Laboratory hours/week**: N/A

F. **Total time of work expected outside of class**: Five (5) to eight (8) hours per week.

G. **Programs that require this course**: Bachelor of Science in Engineering with specialization in Electrical Engineering

H. **Grading**: A-F

I. **Coordination with affected units**: UAA faculty list-serve

J. **Justification for action**: This course requires approval as the General Education Requirement capstone course for the Bachelor of Science in Engineering degree program.

K. **Prerequisite**: N/A

L. **Registration Restrictions**: Student must be in senior year of BSE degree program or faculty permission. Completion of GER TIER 1 (Basic College-level skills) courses.

III. **Course level justification**
Students are required to apply knowledge from courses completed in the 3rd year of the Bachelor of Science in Engineering degree program with Electrical Engineering specialization.

IV. **Course Outline**

A. Introduction and Project Determination
B. Job hunting skills
C. Team concepts and team building
D. Design drawings format as needed for electrical engineering practice and design
E. Specification writing formats as needed for electrical engineering practice and design
F. Design codes and regulations as required for electrical engineering practice and design
G. Project management
H. Safety considerations in electrical engineering design
I. Legal considerations in electrical engineering design
J. Professional registration and the business of electrical engineering
K. Professional engineering volunteer organizations
L. Engineering ethics
M. Public presentation
N. Project Implementation
O. Project Testing
P. Self-Evaluation
Q. Peer Evaluation
R. Presentation and Faculty Evaluation

V. **Instructional Goals and Student Outcomes**

A. Instructional Goals. The instructor will:
    1. Enable students to understand and apply concepts, principles, and skills learned in the undergraduate engineering curriculum, and
    2. Prepare senior electrical engineering students for professional practice.

B. Student Outcomes and Assessment Methods

EE A438 Student Learning Outcomes and Corresponding Methods of Assessment	
Outcome: Students will	**Method of Assessment**
1. Identify problems and opportunities, develop related engineering design criteria, and formulate alternative solutions to meet project specifications while protecting applicable public health, safety, or security concerns	Faculty and other applicable evaluations of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports.
2. Apply knowledge and skills learned in the electrical engineering undergraduate curriculum	Faculty evaluations of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical
3. Function effectively on multi-disciplinary teams to collaborate on iterative design of a complex electrical engineering system with conflicting technical, social, economic, and aesthetic objectives	Faculty evaluation of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports. Peer evaluations of team performance.
4. Demonstrate professional, legal, and ethical responsibilities of practicing electrical engineers	Faculty evaluation of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports.
5. Demonstrate ability to engage in life-long learning in the context of electrical engineering professional practice	Faculty evaluation of work products with emphasis on evidence of self initiated learning of principles not covered in the curriculum to obtain needed information to solve the design problem.
6. Communicate effectively with engineering drawings and technical visualizations, design specifications, written technical reports, and public oral presentations	Faculty evaluation of interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports

VI. **Course Activities**: Students work together in teams to design a electrical engineering devices or systems to meet the project specifications. In addition to the project, weekly lectures cover general topics of concern to practicing engineers. See the Section IV for a typical course outline. Half of the lecture time is spent covering the listed topics. The remaining time is spent in a "staff meeting" to discuss projects and their progress.

VII. **Course Evaluation:** No exams are given in this course. Grades are based on individual and group performance relative to the assigned project. The instructor(s) are to implement a performance assessment process that is similar to that which would be used for employee performance evaluation in a commercial or agency engineering office that consists of faculty and other applicable evaluations of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports.

VIII. **Capstone Requirement Justification**

This course satisfies all of the criteria for a capstone course including the following:

f. Knowledge integration is incorporated as part of the course design,

g. Knowledge integration is specifically addressed as part of outcomes assessment,

h. Four instructional goals and student outcomes are part of the course design including,

v. Effective communication

vi. Critical thinking

vii. Informational literacy

viii. Quantitative perspectives

i. *Performance in Knowledge Integration and instructional goals and student outcomes are assessed,*

j. *Student artifacts are generated that demonstrate achievement of student outcomes.*

Teams of students design complex electrical engineering components or systems under the scrutiny of faculty and other appropriate reviewers that may include a client or project sponsor. This experience integrates knowledge at multiple levels. The design project is chosen that is multidisciplinary in nature meaning that it will incorporate knowledge from the whole BSE curriculum experienced prior to the senior year. Application of scientific principles and advanced engineering computations are required, using computer software and other tools common to current professional engineering practice.

Assessments are conducted in a manner that is essentially equivalent to performance evaluations in the engineering workplace, as conducted by commercial enterprises and public agencies that employ engineers.

Verbal, written, and graphical technical communication at an advanced level, often involving commercially competitive software, is intensely exercised from beginning to end of the course. Inevitable conflicts among design criteria, implementation conditions, and social and economic constraints require critical review and decision-making by the students in the course. Detailed data and related design parameters must be acquired by students in the course from public sources.

Individual students and each specialty team produce a written report with accompanying digital products that is completely professional in appearance, depth of inquiry, technical detail, and excellence of narrative, tabulations, and graphical presentation.

IX. **Suggested Text**: Students will use a variety of reference material, codes and regulations that are applicable to the project of the year.

http://www.ieee.org/portal/site
Homepage of the Institute of Electronic and Electrical Engineers. It includes information on certification, publications, codes, standards and membership information.

IX. **Bibliography and Resources**

Students will use a variety of reference material that is applicable to their projects.

http://www.sematech.org
Sematech is a consortium of American semiconductor manufacturers. It includes full text downloadable technical reports.

http://www.theiet.org
Institution of Engineering and Technology website provides information on publications, news and an online interactive journal, The Computer Forum.

http://www.spie.org
Society of Photo-Optical Instrumentation Engineers website includes society news and information as well as an e-newsletter, OE Reports.

http://www.computer.org/
Online catalog of the Computer Society of IEEE. The site describes publications related to software engineering and information technology.

http://www.darpa.mil/mto/optocenters/UCSD.html
The Optoelectronics Technology Center is a funded collaborative research program in optoelectronics. The group includes University of California at Berkley, Cornell, University of California at San Diego, University of Southern California, University of California at Los Angeles and University of Texas at Austin.

http://www.a2c2.org
Website of the American Automatic Control Council with links to its eight member societies, an online newsletter, and information on conferences and meetings.

http://www.iec.ch/
Website of the International Electrotechnical Commission that provides international standards in the areas of electrical and electronic engineering.

http://www.oida.org

Optoelectronics Industry Development Association website with information on their publications and links to industry organizations, universities, government and international sites.

http://www.egr.uh.edu/dscl/ilink.html

Control Engineering Virtual Library from the University of Houston with listings of control engineering universities, professional societies, journals (some full text and/or table of contents), organizations and companies.

http://www.rpi.edu/dept/cie

Center for Integrated Electronics and Electronics Manufacturing (CIEEM), at Rensselaer Polytechnic Institute. Website has many useful links to other electronics academic institutes.

X. Relationship of Course to Program Outcomes

This course relates to the following Program Outcomes:

a. an ability to apply knowledge of mathematics, science and engineering

b. an ability to design and conduct experiments, as well as to analyze and interpret data

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d. an ability to function on multi-disciplinary teams

e. an ability to identify, formulate and solve engineering problems

f. an understanding of professional and ethical responsibility

g. an ability to communicate effectively

h. the broad education necessary to understand the impact of engineering solutions in a global, economic and societal context

i. a recognition of the need for, and an ability to engage in life-long learning

j. a knowledge of contemporary issues

k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

UNIVERSITY OF ALASKA ANCHORAGE
SCHOOL OF ENGINEERING
COURSE CONTENT GUIDE

ME A438 Design of Mechanical Engineering Systems

Department: Bachelor of Science in Engineering (BSE) **Date**: 10/27/08

Course Prefix, Number, and Title: ME A438 Design of Mechanical Engineering Systems

I. Course Description

Capstone course in which mechanical engineering students design a mechanical engineering component or system starting with the initial design specification to the implementation and testing. Students apply knowledge and skills learned in their undergraduate curriculum.

II. Course Design

A. **Fundamental intent**: Provide mechanical engineering undergraduate students with a capstone design experience and present information important to employment and success as a professional engineer in practice.

B. **Number of Semester Credits**: Three (3)

C. **Course schedule**: Standard semester timeframe.

D. **Lecture hours/week**: Three (3)

E. **Laboratory hours/week**: N/A

F. **Total time of work expected outside of class**: Five (5) to eight (8) hours per week.

G. **Programs that require this course**: Bachelor of Science in Engineering with specialization in Mechanical Engineering

H. **Grading**: A-F

I. **Coordination with affected units**: UAA faculty list-serve

J. **Justification for action**: This course requires approval as the General Education Requirement capstone course for the Bachelor of Science in Engineering degree program with Mechanical Engineering specialization.

K. **Prerequisite**: N/A

L. **Registration Restrictions**: Student must be in senior year of BSE degree program or faculty permission. Completion of GER TIER 1 (Basic College-level skills) courses.

III. Course level justification

Students are required to apply knowledge from courses completed in the 3rd year of the Bachelor of Science in Engineering degree program with Mechanical Engineering specialization**.**

IV. **Course Outline**

1. Introduction and Project Determination
2. Job hunting skills
3. Team concepts and team building
4. Design drawings format as needed for mechanical engineering practice and design
5. Specification writing formats as needed for mechanical engineering practice and design
6. Design codes and regulations as required for mechanical engineering practice and design
7. Project management
8. Safety considerations in mechanical engineering design
9. Legal considerations in mechanical engineering design
10. Professional registration and the business of mechanical engineering
11. Professional engineering volunteer organizations
12. Engineering ethics
13. Public presentation
14. Project Implementation
15. Project Testing
16. Self-Evaluation
17. Peer Evaluation
18. Presentation and Faculty Evaluation

III. Instructional Goals and Student Outcomes

A. Instructional Goals. The instructor will:
   1. Enable students to understand and apply concepts, principles, and skills learned in the undergraduate engineering curriculum, and
   2. Prepare senior mechanical engineering students for professional practice.

B. Student Outcomes and Assessment Methods

ME A438 Student Learning Outcomes and Corresponding Methods of Assessment	
Outcome: Students will	**Method of Assessment**
1. Identify problems and opportunities, develop related engineering design criteria, and formulate alternative solutions to meet project specifications while	Faculty and other applicable evaluations of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to
2. Apply knowledge and skills learned in the mechanical engineering undergraduate curriculum	Faculty evaluations of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports.
3. Function effectively on multi-disciplinary teams to collaborate on iterative design of a complex mechanical engineering system with conflicting technical, social,	Faculty evaluation of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final
4. Demonstrate professional, legal, and ethical responsibilities of practicing mechanical engineers	Faculty evaluation of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final
6. Communicate effectively with engineering drawings and technical visualizations, design specifications, written technical reports, and public oral presentations	Faculty evaluation of interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports

IV. **Course Activities**: Students work together in teams to design a mechanical engineering devices or systems to meet the project specifications. In addition to the project, weekly lectures cover general topics of concern to practicing engineers. See the Section IV for a typical course outline. Half of the lecture time is spent covering the listed topics. The remaining time is spent in a "staff meeting" to discuss projects and their progress.

V. **Course Evaluation:** No exams are given in this course. Grades are based on individual and group performance relative to the assigned project. The instructor(s) are to implement a performance assessment process that is similar to that which would be used for employee performance evaluation in a commercial or agency engineering office that consists of faculty and other applicable evaluations of interactions with multi-disciplinary team members, instructors, and course mentors, interim and final oral presentations of project progress and findings, and contributions of technical drawings, visualizations, and narrative text to interim and final reports.

VI. **Capstone Requirement Justification**

This course satisfies all of the criteria for a capstone course including the following:

k. Knowledge integration is incorporated as part of the course design,

l. Knowledge integration is specifically addressed as part of outcomes assessment,

m. Four instructional goals and student outcomes are part of the course design including,

ix. Effective communication

x. Critical thinking

xi. Informational literacy

xii. Quantitative perspectives

n. *Performance in Knowledge Integration and instructional goals and student outcomes are assessed,*

o. *Student artifacts are generated that demonstrate achievement of student outcomes.*

Teams of students design complex mechanical engineering components or systems under the scrutiny of faculty and other appropriate reviewers that may include a client or project sponsor. This experience integrates knowledge at multiple levels. The design project is chosen that is multidisciplinary in nature meaning that it will incorporate knowledge from the whole BSE curriculum experienced prior to the senior year. Application of scientific principles and advanced engineering computations are required, using computer software and other tools common to current professional engineering practice.

Assessments are conducted in a manner that is essentially equivalent to performance evaluations in the engineering workplace, as conducted by commercial enterprises and public agencies that employ engineers.

Verbal, written, and graphical technical communication at an advanced level, often involving commercially competitive software, is intensely exercised from beginning to end of the course. Inevitable conflicts among design criteria, implementation conditions, and social and economic constraints require critical review and decision-making by the students in the course. Detailed data and related design parameters must be acquired by students in the course from public sources.

Individual students and each specialty team produce a written report with accompanying digital products that is completely professional in appearance, depth of inquiry, technical detail, and excellence of narrative, tabulations, and graphical presentation.

VII. **Suggested Text:** Students will use a variety of reference material, codes and regulations that are applicable to the project of the year.

http://www.asme.org/
Homepage of the American Society of Mechanical Engineers. It includes information on certification, publications, codes, standards and membership information.

VIII. Bibliography and Resources

Students will use a variety of reference material that is applicable to their projects.

http://www.ame.org
Network site for Association of Manufacturing Excellence.

http://www.eevl.ac.uk/ram
Recent Advances in Manufacturing is a database of bibliographic information covering manufacturing and related areas.

http://www.aspe.net/index.html
Website of the American Society for Precision Engineering and includes recommended books, journals and links to other precision engineering sites.

http://steelynx.net/fea.html
Finite Element Analysis Methods contains links to numerous finite element method resources on the web.

http://phys.educ.ksu.edu
Website from Kansas State University that is an excellent resource on quantum mechanics with interactive tutorials.

http://www.mel.nist.gov/melhome.html
Website of the Manufacturing Engineering Laboratory of NIST (National Institute of Standards and Technology), Federal government agency.

http://www.matweb.com
This materials website provides datasheets on over 40,000 metals, plastics, ceramics and composites. This is an excellent resource if you are researching materials for a design project.

http://www.memagazine.org
Online edition of Mechanical Engineering magazine. It includes a search engine that can search issues of the journal as well as the web.

IX. Relationship of Course to Program Outcomes

This course relates to the following Program Outcomes:

a. an ability to apply knowledge of mathematics, science and engineering

b. an ability to design and conduct experiments, as well as to analyze and interpret data

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d. an ability to function on multi-disciplinary teams

e. an ability to identify, formulate and solve engineering problems

f. an understanding of professional and ethical responsibility

g. an ability to communicate effectively

h. the broad education necessary to understand the impact of engineering solutions in a global, economic and societal context

i. a recognition of the need for, and an ability to engage in life-long learning

j. a knowledge of contemporary issues

k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Grading

Attendence is required by all students at all scheduled lectures and laboratories.

Team Groups

Teams include three to seven persons each. Each team receives a different project assignment that is developed with the faculty member, and with the industry spnsor if applicable.
Each team is required to have a faculty advisor. The team is expected to work with its Faculty Advisor throughout the semester.

Each team will produce a series of reports and presentations as the semester progresses, culminating in a final written report. The sponsor and faculty advisor feedback will be used to determine final grades.

GRADING	
Description	**Grade Weight (%)**
Team Grades	
Oral Project Proposal (Oral and written presentations)	10
Gantt Chart	5
Design Review Report	5
Outline of Final Written Report	5
Written Final Report	40
Oral Presentation to students, sponsors, faculty & public	15
Individual Grades	
Attendance	10
Project Notebook	10
TOTAL	**100**

The four most important factors in determining your final grade are the quality of the following:

1. design solution

2. project notebook

3.written report

4. final oral presentation

Design Notebook

Each team member is responsible for their design notebook. The notebook keeps a record of all major event related to the design projects such as design notes, plant trip information, Gantt charts, calculations, and any other item related to the project.

Academic Dishonesty

The University policy on academic dishonesty is enforced. All referenced material that is not original should be referenced. The policies on academic dishonesty may are located int eh UAA Student Fact Finder at: http://www.uaa.alaska.edu/studentaffairs/fact-finder.cfm

Deadlines

Deadlines for all graded materials will be established at the start of the course and will be available on the course website.

Project Proposal

The Project Proposal does the following:

1. States and defines the problem

2. Provides background information

3. Decribes the problem through clear drawings, computer programs, written descriptions.

4. Outlines the method and steps for solvingthe problem.

5. Provides any conditions set by the sponsor if applicable.

Gantt Chart

Scheduling of all major activities is donethrough a Gantt chart to ensure the project is completed in a timely manner. It covers the entire semester and includes all key decisions and tasks performed by the team members.

Project Notebook

The most important document produced by a team member is their project notebook. All entries are made in non-erasable ink. Te notebook contains all ideas, notes, activites, design concepts, sample calculations, and contributions to the project.

Written Report Guidelines

Example reports will be made available through the faculty advisor and will provide format for pagination, cover sheets, figures and tables, font, drawings, references, etc.

All reports are to be completed in WORD 2007 and Adobe PDF formats. Three hardcopies are required for submittal along with electronic formats. The following Table of Contents provides the general format and numbering structure for the reports.

TABLE OF CONTENTS

Acknowledgements
This section is usually one page or less but is still very important. Everyone involved that contributed to the project should be identified witht a short description of their contribution.

Table of Contents, List of Figures, List of Tables
All use the format provided in the above example.

Executive Summary
Summarizes the problem and the solution and identifies where to find the discussions within the report. This section is usually easiest to write last.

Introduction
This section provides a review of the literature related to your project including applicable patents or previous work that is similar or forms the basis upon which your work extends or improves or distinctly advances a previous design, or how your design is unique from the previous work. This section is should provides the reader with understanding of the purpose of the project, and should include a statement of the central problem or hypothesis of the analysis presented in the report. The statement must contain sufficient background information to enable a reader to grasp the importance of the work. After reading the Introduction, the reader should know what is to follow in later sections and how the argument will unfold. The entire report should be written in third-person-singular professional language and not in a conversational style.

Literature/Previous Work Review
Establishes how the report fits into the existing body of knowledge on the topic. It should explain how, based on findings cited from published literature, the work presented will contribute to knowledge of the topic. This should be achieved with a narrative discussion of all relevant prior work leading to a logical statement justifying the value of the project in light of the literature reviewed. After reading the Literature Review section, the reader should understand how the report contributes to knowledge in the field and how existing literature supports the premise.

Methods and Materials:
Provides the reader with an understanding of how the project was carried out. Enough detail must be presented so that someone reading the work has complete information to repeat the work in an attempt to reproduce the results. It should specify sources of instruments, equipment, and materials with model numbers and provide a step-by-step description of procedures applied or references to such an unambiguous understanding of how results were achieved.

Results
Presents the results of any experimental work, original thought and development, and must discuss them in light of the background developed in preceding sections of the project report, especially as it relates to the problem statement and how results align with other relevant research and development. At the end of the Results section, the reader should have a clear idea of what new information has been provided and what this information means as a contribution to the field.

Conclusions

List of conclusions, each with a short amplifying statement. Amplifying statements should explain how each conclusion aligns with previous knowledge concerning the topic.

Recommendations

List of recommendations for future work on the same subject or problem, each with a short amplifying statement. Recommendations may propose specific research and development or changes in professional practice or public policy. Amplifying statements should indicate how the recommendations could be carried out.

References

Full reference to all sources of information cited in the report. Literature not cited in the report should not appear in the References section.

Codes and Standards

Reference and described all professional design codes that were applied in your design.

Curriculum Inclusion

Describe how the courses you took throughout your college degree were applied in your design or were used. Provide the name of the course and specify how each was applied. This should include at least the engineering courses, and could also include English, math, physics, chemistry, etc.

Appendices

Includes all material pertainent to understanding and documenting the discussions within the report. Patents, codes, articles, etc. can be included.

Code of Ethics

National Society of Professional Engineers

Code of Ethics for Engineers: **http://www.nspe.org/ethics/index.html**

NSPE Code of Ethics for Engineers

Preamble
Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

I. Fundamental Canons
Engineers, in the fulfillment of their professional duties, shall:

Hold paramount the safety, health, and welfare of the public.

Perform services only in areas of their competence.

Issue public statements only in an objective and truthful manner.

Act for each employer or client as faithful agents or trustees.

Avoid deceptive acts.

Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

II. Rules of Practice

Engineers shall hold paramount the safety, health, and welfare of the public.

If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.

Engineers shall approve only those engineering documents that are in conformity with applicable standards.

Engineers shall not reveal facts, data, or information without the prior consent of the client or employer except as authorized or required by law or this Code.

Engineers shall not permit the use of their name or associate in business ventures with any person or firm that they believe is engaged in fraudulent or dishonest enterprise.

Engineers shall not aid or abet the unlawful practice of engineering by a person or firm.

Engineers having knowledge of any alleged violation of this Code shall report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required.

Engineers shall perform services only in the areas of their competence.

Engineers shall undertake assignments only when qualified by education or experience in the specific technical fields involved.

Engineers shall not affix their signatures to any plans or documents dealing with subject matter in which they lack competence, nor to any plan or document not prepared under their direction and control.

Engineers may accept assignments and assume responsibility for coordination of an entire project and sign and seal the engineering documents for the entire project, provided that each technical segment is signed and sealed only by the qualified engineers who prepared the segment.

Engineers shall issue public statements only in an objective and truthful manner.

Engineers shall be objective and truthful in professional reports, statements, or testimony. They shall include all relevant and pertinent information in such reports, statements, or testimony, which should bear the date indicating when it was current.

Engineers may express publicly technical opinions that are founded upon knowledge of the facts and competence in the subject matter.

Engineers shall issue no statements, criticisms, or arguments on technical matters that are inspired or paid for by interested parties, unless they have prefaced their comments by explicitly identifying the interested parties on whose behalf they are speaking, and by revealing the existence of any interest the engineers may have in the matters.

Engineers shall act for each employer or client as faithful agents or trustees.

Engineers shall disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services.

Engineers shall not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed and agreed to by all interested parties.

Engineers shall not solicit or accept financial or other valuable consideration, directly or indirectly, from outside agents in connection with the work for which they are responsible.

Engineers in public service as members, advisors, or employees of a governmental or quasi-governmental body or department shall not participate in decisions with respect to services solicited or provided by them or their organizations in private or public engineering practice.

Engineers shall not solicit or accept a contract from a governmental body on which a principal or officer of their organization serves as a member.

Engineers shall avoid deceptive acts.

Engineers shall not falsify their qualifications or permit misrepresentation of their or their associates' qualifications. They shall not misrepresent or exaggerate their responsibility in or for the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of employment shall not misrepresent pertinent facts concerning employers, employees, associates, joint venturers, or past accomplishments.

Engineers shall not offer, give, solicit, or receive, either directly or indirectly, any contribution to influence the award of a contract by public authority, or which may be reasonably construed by the public as having the effect or intent of influencing the awarding of a contract. They shall not offer any gift or other valuable consideration in order to secure work. They shall not pay a commission, percentage, or brokerage fee in order to secure work, except to a bona fide employee or bona fide established commercial or marketing agencies retained by them.

III. Professional Obligations

Engineers shall be guided in all their relations by the highest standards of honesty and integrity.

Engineers shall acknowledge their errors and shall not distort or alter the facts.

Engineers shall advise their clients or employers when they believe a project will not be successful.

Engineers shall not accept outside employment to the detriment of their regular work or interest. Before accepting any outside engineering employment, they will notify their employers.

Engineers shall not attempt to attract an engineer from another employer by false or misleading pretenses.

Engineers shall not promote their own interest at the expense of the dignity and integrity of the profession.

Engineers shall at all times strive to serve the public interest.

Engineers are encouraged to participate in civic affairs; career guidance for youths; and work for the advancement of the safety, health, and well-being of their community.

Engineers shall not complete, sign, or seal plans and/or specifications that are not in conformity with applicable engineering standards. If the client or employer insists on such unprofessional conduct, they shall notify the proper authorities and withdraw from further service on the project.

Engineers are encouraged to extend public knowledge and appreciation of engineering and its achievements.

Engineers are encouraged to adhere to the principles of sustainable development[1] in order to protect the environment for future generations.

Engineers shall avoid all conduct or practice that deceives the public.

Engineers shall avoid the use of statements containing a material misrepresentation of fact or omitting a material fact.

Consistent with the foregoing, engineers may advertise for recruitment of personnel.

Consistent with the foregoing, engineers may prepare articles for the lay or technical press, but such articles shall not imply credit to the author for work performed by others.

Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve.

Engineers shall not, without the consent of all interested parties, promote or arrange for new employment or practice in connection with a specific project for which the engineer has gained particular and specialized knowledge.

Engineers shall not, without the consent of all interested parties, participate in or represent an adversary interest in connection with a specific project or proceeding in which the engineer has gained particular specialized knowledge on behalf of a former client or employer.

Engineers shall not be influenced in their professional duties by conflicting interests.

Engineers shall not accept financial or other considerations, including free engineering designs, from material or equipment suppliers for specifying their product.

Engineers shall not accept commissions or allowances, directly or indirectly, from contractors or other parties dealing with clients or employers of the engineer in connection with work for which the engineer is responsible.

Engineers shall not attempt to obtain employment or advancement or professional engagements by untruthfully criticizing other engineers, or by other improper or questionable methods.

Engineers shall not request, propose, or accept a commission on a contingent basis under circumstances in which their judgment may be compromised.

Engineers in salaried positions shall accept part-time engineering work only to the extent consistent with policies of the employer and in accordance with ethical considerations.

Engineers shall not, without consent, use equipment, supplies, laboratory, or office facilities of an employer to carry on outside private practice.

Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers. Engineers who believe others are guilty of unethical or illegal practice shall present such information to the proper authority for action.

Engineers in private practice shall not review the work of another engineer for the same client, except with the knowledge of such engineer, or unless the connection of such engineer with the work has been terminated.

Engineers in governmental, industrial, or educational employ are entitled to review and evaluate the work of other engineers when so required by their employment duties.

Engineers in sales or industrial employ are entitled to make engineering comparisons of represented products with products of other suppliers.

Engineers shall accept personal responsibility for their professional activities, provided, however, that engineers may seek indemnification for services arising out of their practice for other than gross negligence, where the engineer's interests cannot otherwise be protected.

Engineers shall conform with state registration laws in the practice of engineering.

Engineers shall not use association with a nonengineer, a corporation, or partnership as a "cloak" for unethical acts.

Engineers shall give credit for engineering work to those to whom credit is due, and will recognize the proprietary interests of others.

Engineers shall, whenever possible, name the person or persons who may be individually responsible for designs, inventions, writings, or other accomplishments.

Engineers using designs supplied by a client recognize that the designs remain the property of the client and may not be duplicated by the engineer for others without express permission.

Engineers, before undertaking work for others in connection with which the engineer may make improvements, plans, designs, inventions, or other records that may justify copyrights or patents, should enter into a positive agreement regarding ownership.

Engineers' designs, data, records, and notes referring exclusively to an employer's work are the employer's property. The employer should indemnify the engineer for use of the information for any purpose other than the original purpose.

Engineers shall continue their professional development throughout their careers and should keep current in their specialty fields by engaging in professional practice, participating in continuing education courses, reading in the technical literature, and attending professional meetings and seminars.

Footnote 1 "Sustainable development" is the challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste

management while conserving and protecting environmental quality and the natural resource base essential for future development.

—As Revised July 2007

By order of the United States District Court for the District of Columbia, former Section 11(c) of the NSPE Code of Ethics prohibiting competitive bidding, and all policy statements, opinions, rulings or other guidelines interpreting its scope, have been rescinded as unlawfully interfering with the legal right of engineers, protected under the antitrust laws, to provide price information to prospective clients; accordingly, nothing contained in the NSPE Code of Ethics, policy statements, opinions, rulings or other guidelines prohibits the submission of price quotations or competitive bids for engineering services at any time or in any amount.

Statement by NSPE Executive Committee

In order to correct misunderstandings which have been indicated in some instances since the issuance of the Supreme Court decision and the entry of the Final Judgment, it is noted that in its decision of April 25, 1978, the Supreme Court of the United States declared: "The Sherman Act does not require competitive bidding."
It is further noted that as made clear in the Supreme Court decision:

Engineers and firms may individually refuse to bid for engineering services.

Clients are not required to seek bids for engineering services.

Federal, state, and local laws governing procedures to procure engineering services are not affected, and remain in full force and effect.

State societies and local chapters are free to actively and aggressively seek legislation for professional selection and negotiation procedures by public agencies.

State registration board rules of professional conduct, including rules prohibiting competitive bidding for engineering services, are not affected and remain in full force and effect. State registration boards with authority to adopt rules of professional conduct may adopt rules governing procedures to obtain engineering services.

As noted by the Supreme Court, "nothing in the judgment prevents NSPE and its members from attempting to influence governmental action . . ."

NOTE: In regard to the question of application of the Code to corporations vis-à-vis real persons, business form or type should not negate nor influence conformance of individuals to the Code. The Code deals with professional services, which services must be performed by real persons. Real persons in turn establish and implement policies within business structures. The Code is clearly written to apply to the Engineer, and it is incumbent on members of NSPE to endeavor to live up to its provisions. This applies to all pertinent sections of the Code.

Criteria for Accrediting Programs in Engineering

http://www.abet.org/

Effective for Evaluations during the 2009-2010 Accreditation Cycle

Criteria for ALL Engineering Programs: **http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/E001%2009-10%20EAC%20Criteria%2012-01-08.pdf**

See the specific sections under **"**GENERAL CRITERIA FOR BACCALAUREATE LEVEL PROGRAMS" and for the specific program of "Electrical and Computer Engineering" or "Mechanical Engineering".