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:

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 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.