ABET
Self-Study Report

for the

B.S. Mechanical Engineering Program

at

University of Alaska Fairbanks

Fairbanks, Alaska

June 2011

CONFIDENTIAL

UAF College of Engineering & Mines

Table of Contents

BACKGROUND INFORMATION

A. Contact Information

Dr. Jonah Lee
Professor of Mechanical Engineering and Department Chair
PO Box 755905
University of Alaska Fairbanks
Fairbanks AK 99775-5905
(907) 474-5160
(907) 474-6141 (fax)
jonah.lee@alaska.edu

B. Program History

The Bachelor of Science (BS) program in Mechanical Engineering was implemented at UAF in 1980. The last full ABET review of the BS program occurred in 2005. An interim program evaluation occurred in 2007–2008. A 5-year integrated BS/MS program was approved by the University of Alaska Board of Regents in 2009. Currently, 5 students are enrolled in the BS/MS program, and no students have yet graduated from the BS/MS program.

C. Options

Students may optionally choose to obtain an emphasis in either Petroleum or Aerospace engineering. Both options require specific courses to be taken when satisfying their elective requirements. The area of emphasis is indicated on the student's certificate of graduation. The program also offers a 5-year integrated BS/MS program.

D. Organizational Structure

The University of Alaska Fairbanks (UAF), www.uaf.edu, with its main campus in Fairbanks, Alaska, is one of the three universities that together form the University of Alaska (UA) System. The other two are the University of Alaska Anchorage, UAA, with a main campus in Anchorage, Alaska, and the University of Alaska Southeast, UAS, with a main campus in Juneau, Alaska. Academics at UAF are spread primarily across "Schools" and "Colleges," with "Schools" being narrower in focus and smaller in size than "Colleges." There are four colleges at UAF, including the College of Engineering and Mines, the College of Liberal Arts, the College of Natural Science and Mathematics, and the College of Rural and Community Development. There are also four schools, including the School of Management, the School of Fisheries and Ocean Sciences, the School of Natural Resources and Agricultural Sciences, and the School of Education.

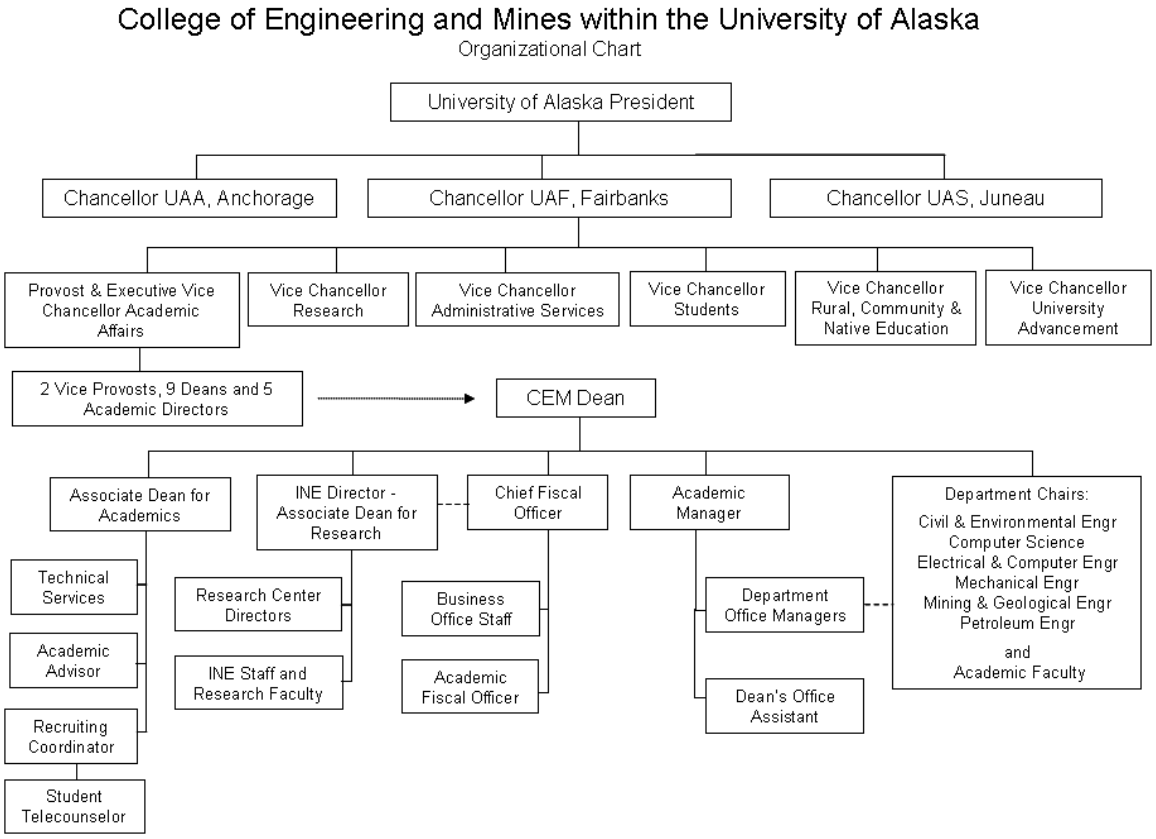
Academic Organization

There are six academic departments within the College of Engineering and Mines (CEM), www.alaska.edu/uaf/cem, including the Department of Civil and Environmental Engineering, the Department of Computer Science, the Department of Electrical and Computer Engineering, the Department of Mechanical Engineering, the Department of Mining and Geological Engineering, and the Department of Petroleum Engineering. CEM is led by a Dean and two Associate Deans, one for academics and one for research. The Associate Dean for Research also serves as the Director of the Institute of Northern Engineering.

Research Organization
The Institute of Northern Engineering (INE), ine.uaf.edu, is the research arm of the College of Engineering and Mines. Most college research is conducted through INE, which provides support for proposal preparation and project management for externally funded grants. Within the institute are seven centers in which focused research, development, and testing takes place. INE promotes interdisciplinary and collaborative research and development; promotes partnerships with the natural and social sciences, education, business, geography, natural resource management, and law; promotes outreach; and fosters opportunities for faculty, postdoctoral researchers, and students to engage in research.

The College of Engineering and Mines was formed in 2004 with the merger of the five engineering departments. Prior to 2004, the engineering departments were in two separate colleges, along with other departments. The Computer Science Department joined CEM in 2010.

The following organizational chart shows how the college is organized internally and within the UA System.



E. Program Delivery Modes
The BS and BS/MS programs are offered as day programs, utilizing traditional lecture/laboratory delivery.

F. Program Locations
The program is offered at the Fairbanks campus of the University of Alaska.

G. Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions Taken to Address Them

The most recent ABET final statement was issued August 15, 2008, after the EAC's 2008 Summer Meeting. Two weaknesses were reclassified as concerns, one weakness was resolved, and one concern was resolved. The remaining concerns are:

1. Criterion 2 Program Educational Objectives *The previous program review notes that the educational objectives for the mechanical engineering program were worded such that they stated goals for the faculty, not expected achievements of program graduates. In addition, the processes of involving constituencies, the periodic evaluation of the appropriateness of the objectives, and determination of the achievement of the objectives were all ad-hoc. The evaluation process did not include time lines and the assignment of responsibilities to ensure compliance.*

   Action
   The program educational objectives have been recast to describe career and professional accomplishments that the program is preparing graduates to achieve (effective 2006). The employer surveys have been modified to include questions regarding the achievement of these objectives by the graduates, and the appropriateness of the current objectives (effective 2008). Additionally, the program objectives are discussed and evaluated during the on-campus meeting with the program's industrial advisory committee.

2. Criterion 3 Program Outcomes and Assessment *The assessment process was largely ad-hoc and relied nearly exclusively on student self assessment in the form of end-of-class surveys. FE exam results were available but not being clearly tied to specific outcomes. Performance criteria were not stated for the assessment instruments. Also, achievement of outcomes (b) and (i) were shown but lacked a solid tie to the curriculum to ensure sustained achievement.*

   Action
   The FE exam sub-scores are now used and tied directly to specific program outcomes. Student achievement in these areas is assessed annually using these results (effective 2008). The end-of-class surveys have been replaced with a more comprehensive and objective Faculty Course Assessment Report (FCAR). Completed by the faculty member, this report includes objective measures of student outcomes that can be quantitatively assessed each semester (effective 2008). All student outcomes, including outcomes (b) and (i), are assessed with this instrument, providing a more consistent and sustained process.

H. Joint Accreditation

The program is not jointly accredited, nor is it seeking joint accreditation.

GENERAL CRITERIA

CRITERION 1. STUDENTS

A. Student Admissions

There are three pathways for a student to be admitted to the BS Mechanical Engineering program. The requirements are:

1. As a first time freshmen, the student needs, at the minimum, all of the following:
    a. High school diploma or equivalent
    b. Pass a high school core of 16 credits with a minimum GPA of 2.5
    c. Must have taken SAT/ACT in the past two years
    d. High school GPA of 3.0 OR
        i. High school GPA of 2.5 AND
        ii. ACT composite score of 18 or SAT total score of 1290 (writing skills included)
    e. Must have completed the following in high school: 4 credits of English, 2 credits of algebra, 1 credit of geometry, ½ credit of trigonometry (an additional ½ credit of advanced math is recommended), 3 credits of social sciences, 1 credit of physics or chemistry, 1 credit of natural sciences, 1 credit of elective. Both physics and chemistry are recommended.
2. As a transfer student, the student needs, at the minimum, all of the following:
    a. If the student is transferring with at least 30 credits, then
        i. Must have left the previous institution in good academic standing
        ii. Must have a minimum GPA of 2.0 in each transferred course
        iii. Transferred course work must be relevant to engineering
    b. If the student is transferring with less than 30 credits, then they must meet freshmen admission standards.
3. As a change of major for a current UAF student in a four-year degree program, the student needs the approval of the department chair. A student in a two-year program cannot change their major into a four-year degree program; they have to apply for admission into the program.

If students do not meet the requirements, they are placed into a “pre-major” sub-group of the department. This applies even to change of majors. The first two pathways are administered by the Office of Admissions (including making the admission decision), while the last pathway is handled by the Registrar’s Office, with the admission decision resting on the chair of the department.

B. Evaluating Student Performance

UAF requires early grade reports for all freshmen students at the end of 6 weeks. These grades are reported to students on their UA Online account. The goal is to give freshman students early feedback on their performance in all classes. With early grade information students can take appropriate action of seeking help in specific classes, giving more attention to classes where they are not performing optimally, or if necessary withdrawing from a class before the deadline for student-initiated withdrawal. Help is available in several tutoring centers, including the College of Engineering and Mines Tutoring Center, the Math Lab, and others. CEM employs an academic advisor, who concentrates on incoming freshmen and lower-division students, but can advise students at all levels. The CEM Academic Advisor can provide guidance to students on their options to appropriately deal with lower than optimum early grade reports.

To remain in good academic standing, UAF requires undergraduate students maintain a cumulative GPA and most recent semester GPA of 2.0 or better.

Students whose cumulative and/or semester GPA falls below 2.0 after each fall and spring semester will be put on academic probation. Students on probation may not enroll in more than 13 credits a semester, unless an exception is granted by the appropriate dean. Probation may include additional conditions, as determined by the dean of the college or school in which the student's major is located. Students on probation will be referred for developmental advising/education and/or to an advising or support counseling center. Removal from probation requires the student's cumulative and semester GPAs to be at least 2.0.

The CEM Academic Advisor communicates with all CEM students on probation after each semester, seeking to guide them on appropriate actions for the student to take, including revising course selection for the following semester.

The UAF registration system implemented the "Banner Mandatory Placement" prerequisite and co-requisite verification prior to registration on each course a couple of years ago, with CEM volunteering to be a test college. All registration occurs on line, and students cannot register for courses for which they do not have the proper prerequisites and co-requisites. This process has greatly reduced problems of students being in courses without having the proper prerequisites, a condition which sets them up for trouble and possible failure. There are occasionally extenuating circumstances. CEM has a prerequisite and co-requisite waiver form which is used to document any waived prerequisite or co-requisite, justification for the waiver, including conditions and date conditions, and student, instructor, advisor and department chair signatures.

Faculty and students also have access to *DegreeWorks*[©], an online system that allows them to monitor progress and conduct what-if analyses with graduation. This is in addition to *UAOnline* that allows them to view transcripts online.

Once lower-division students are formally admitted to the Mechanical Engineering degree program, they are assigned a faculty advisor from within the department. The advisor meets with each student individually before registration for the following semester in order to review past performance, discuss and review possible poor performance that results in academic probation,

[©] SunGard Higher Education

assure that proper prerequisites and co-requisites are being met, and plan for future courses and a graduation timeline. The advisor's signature is required each semester before the student may register for classes. Students remain with the same faculty advisor during the entire time they are in the undergraduate program. When a faculty member is on leave such as sabbatical, their students are temporarily assigned to a different faculty member.

C. Transfer Students and Transfer Courses

A transfer student is defined as someone coming into the university with at least 30 transferable semester credits. Transfer students are eligible for admission to a baccalaureate program if they have a 2.0 GPA in their previous course work and left their previous institution(s) in good standing. If applying to a technical or scientific program, students may need to present a higher grade average and proof that they have completed appropriate background courses before they will be admitted. Students transferring into a baccalaureate degree program with fewer than 30 semester hours of transferable credit must also meet the freshman admission requirements. Admission status for students who have attended an unaccredited postsecondary institution will be determined on an individual basis.

Credit accepted at UAF that has been earned from other regionally accredited institutions, through military educational experiences or credit accepted by special approval is considered transfer credit. Where possible, transfer credit is equated with UAF courses. Lists of substitutions within the University of Alaska System are available on page 36 of the UAF Catalog. Standard substitutions from non-University of Alaska institutions are also available on page 37. UAF is a member of the Servicemembers Opportunity Colleges (SOC) network. For additional information about the SOC program, contact the Office of Admissions.

UAF's transfer credit resource website (uaonline.alaska.edu) is an unofficial reference for undergraduate students who are considering transferring to UAF. An official evaluation of transfer credits may be obtained only after formal application and admission to degree-seeking status with UAF.

In order to serve students who transfer among the three institutions that make up the University of Alaska System, UAF, UAA and UAS have identified fully transferable general education requirements for baccalaureate degrees. Credit for course work successfully completed at one UA institution that applies to general education requirements will fulfill the same categories at all other institutions. This applies even if there is no directly matching course work at the institution to which the student transfers. Transfer students from UAA or UAS who have completed all general education requirements in the baccalaureate program prior to transferring to UAF will have completed all requirements for the UAF baccalaureate core. Courses taken to complete the general education requirements at UAA or UAS will meet UAF baccalaureate core requirements according to the current table of substitutions for intra-UA transfers. Completion of the 35-credit lower-division requirements (100- and 200-level courses) of the UAF baccalaureate core meets the general education requirements at the UAA and UAS. More information about transfer credit is available at www.uaf.edu/admissions/undergrad/transfer. The Transfer Credit Resource Database is used to facilitate transfer of other courses.

The UAF Admissions Office evaluates transfer students and course credits, often calling the department chair for specific engineering or computer science course-transfer equivalencies. The standard approach for evaluating course equivalency is to compare course syllabi, noting course content, course level, prerequisites, course textbook, and credit hours. Sometimes there may not be a direct 1-to-1 course transfer equivalency, but there is often a block of transfer courses that can be demonstrated to be equivalent to several UAF courses. This type of block transfer is especially important when students transfer from a university on the quarter system. Each quarter credit hour is equivalent to 2/3 of a semester credit hour.

D. Advising and Career Guidance

CEM employs an academic advisor, who concentrates on incoming freshmen and lower-division students, but can advise students at all levels. Once engineering and computer science students start taking classes within their department, advising is transferred to the department. Some incoming freshmen go straight to the department for advising and bypass the CEM Academic Advisor. The CEM Academic Advisor maintains an office with posted office hours and is generally easy to find. This individual is well trained in many of the questions and situations encountered by incoming freshmen. The duties of the position include the following:

a. Advising students on academic course selection, especially incoming freshmen during the summer months. After students are established in a discipline, they are generally transitioned to department faculty for advising. The advisor position is a 12-month position, so students that visit in the summer or try to register in the summer are generally advised by the CEM Academic Advisor.
b. Helping students with non-academic, as well as academic, issues including housing, financial aid information, university resources for transitioning to college life, and study skills workshops.
c. Acting as an early intervention advisor for freshmen who do not perform well in the first few weeks of a semester, as indicated by poor attendance or low homework scores. These students are contacted by the academic advisor to see if something can be done to mitigate the situation.
d. Overseeing the engineering tutoring lab, which includes hiring tutors and maintaining records of use.

All students admitted to the Mechanical Engineering (ME) program are assigned a ME faculty advisor. The advisor meets with the student every semester to advise them on future courses and help plan a timeline for graduation. Incoming students are usually assigned randomly and evenly between the faculty members, although there are occasional circumstances where a student may request a particular advisor due to a pre-established academic relationship.

Students cannot register without consulting with an advisor. UAF has a central advising operation, the Academic Advising Center. To improve advising across campus, the Academic Advising Center now only sees undeclared majors and general studies students. Students with declared majors are sent to their units for advising. The 12-month availability of the CEM Academic Advisor greatly improves advising for engineering students.

The mission of UAF Career Services (www.uaf.edu/career) is “The Department of Career Services assists individuals in identifying and implementing career choices. We provide career

counseling, job search and internship advising, and on campus employer recruiting to students, alumni, staff and faculty." Career Services is active in providing engineering and computer recruiting events, and holds multiple targeted recruitment/employer events on campus every year.

Within the department, the student professional organization (ASME and SAE) routinely advises students on extracurricular opportunities, and encourages them to play an active role within the organization, which enhances their career opportunities. Examples of these include student participation in ASME student paper competitions and SAE Clean Snowmobile activities.

E. Work in Lieu of Courses

While it is possible for a student to utilize past professional experience to obtain course credit, this is generally not granted except for general introductory courses when the student has good work experience in the field. Most professional experiences do not cover every aspect of an engineering course, and most engineering courses include calculus-based analysis and design aspects, which is a much deeper level of comprehension than the technician-level experience of most pre-engineering work experience. Other ways to obtain credits for work in lieu of courses include advanced placement (AP) credit, high SAT/ACT scores, and testing out. Advanced placement in certain courses is possible for incoming students provided they have a 3 or above in the appropriate College Board (CEEB) AP course test from high school. Similarly, students with high SAT/ACT scores in the appropriate category can get credit for ENGL 111X. Students can test out of a few courses through the nationwide College Level Examination Program (CLEP). However, both advance placement and testing out are possible only for a few credits of lower-level courses. The UAF Catalog details alternate ways to obtain credit (www.uaf.edu/catalog/current/admissions/transfer_placement.html#Alternate_Ways).

F. Graduation Requirements

The UAF Graduation Office certifies that students meet the degree requirements. This information is available to students and faculty on *DegreeWorks*©.

College Admission Requirements (from 2010 UAF Catalog)

For admission to baccalaureate-level programs, applicants must:

A. have a high school diploma*, and
B. pass the 16-credit high school core curriculum with a GPA of at least 2.5, and
C. submit results of the ACT Plus Writing (preferred) or SAT taken within the last two years, and
    - have an overall high school GPA of at least 3.0, OR
    - have an overall high school GPA of at least 2.5 AND ACT Plus Writing composite score of at least 18 or SAT total score of at least 1290.

Admission to a specific baccalaureate degree program is based on a combination of the student's high school GPA and completion of specific high school courses.

Test results from the ACT Plus Writing (preferred) or SAT must be received before a student can be fully admitted. Test results must be less than two years old. This requirement will be waived

© SunGard Higher Education

for students who have successfully completed, with a grade of C or better, the equivalent of 3 credits of 100-level math and 100-level English composition from a regionally accredited institution of higher education within the last two years.
* *To earn a high school diploma in Alaska, you must fulfill all curriculum requirements and satisfactorily complete all three competency areas of the High School Qualifying Exam.*

Transfer Students (from 2010 UAF Catalog)
A transfer student is defined as someone coming into the university with at least 30 transferable semester credits. Transfer students are eligible for admission to a baccalaureate program if they have a 2.0 GPA in their previous course work and left their previous institution(s) in good standing. If applying to a technical or scientific program, students may need to present a higher grade average and proof that they have completed appropriate background courses before they will be admitted. Students transferring into a baccalaureate degree program with fewer than 30 semester hours of transferable credit must also meet the freshman admission requirements listed on page 25. Admission status for students who have attended an unaccredited postsecondary institution will be determined on an individual basis.

Common First-Year Engineering Curriculum
The first-year Engineering curriculum commonly includes 1 year of English, 1 year of calculus, introduction to engineering, 1 year of chemistry, and an introduction to computer programming.

Time to Completion of Degree
The average time for completion of the BS degree in Mechanical Engineering is a little more than 4 years, which is reasonable considering the fact that the department is a small one and all required courses are offered only once per year. This program has many incoming transfer students, who often take longer to finish.

Degree Requirements
1. Complete the general university requirements. (As part of the core curriculum requirements, complete: MATH 200X; CHEM 105X and CHEM 106X.).
2. Complete the general B.S. degree requirements. (As part of the B.S. degree requirements, complete: MATH 201X, PHYS 211X and PHYS 212X.).
3. Complete the following: program (major) requirements:*
    ES 101 – Introduction to Engineering (2 credits)
    ES 201 – Computer Techniques (3 credits)
    ES 209 – Statics (3 credits)
    ES 210 – Dynamics (3 credits)
    ES 301 – Engineering Analysis (3 credits)
    ES 307 – Elements of Electrical Engineering (3 credits)
    ES 331 – Mechanics of Materials* (3 credits)
    ES 341 – Fluid Mechanics* (4 credits)
    ES 346 – Basic Thermodynamics* (3 credits)
    ESM 450W – Economic Analysis and Operations (3 credits)
    MATH 202X – Calculus (4 credits)
    MATH 302 – Differential Equations (3 credits)
    ME 302 – Mechanical Design I (4 credits)

ME 308 – Instrumentation and Measurement (3 credits)
ME 313 – Mechanical Engineering Thermodynamics (3 credits)
ME 321 – Industrial Processes (3 credits)
ME 334 – Elements of Material Science/Engineering (3 credits)
ME 403 – Mechanical Design II (3 credits)
ME 408 – Dynamics of Systems (3 credits)
ME 415W – Thermal Systems Laboratory (3 credits)
ME 441 – Heat and Mass Transfer (3 credits)
ME 487W, O – Design Project (3 credits)
ME electives** (6 credits)
Technical electives*** (3 credits)
Electives (2 credits)

4. Minimum credits required (131 credits)

** Student must earn a C grade or better in each of the program (major) requirements, with exception of ES 101.*
*** Mechanical engineering course at 400-level or above.*
**** Engineering course at 400-level or above.*

Note: Students electing to complete an emphasis in aerospace engineering must complete the sequence of aerospace courses (ME 450, 451, 452, and 453).

Note: Students electing to complete an emphasis in petroleum engineering must complete the sequence of petroleum-related courses (ME 409 and 416 or equivalent, plus two 400-level PETE courses) as part of their program requirements and complete a senior design project that is related to petroleum engineering.

Note: Students must plan their elective courses in consultation with their mechanical engineering faculty advisor, and obtain the advisor's approval for all elective courses.

Student Advising

All students in the ME program are advised by ME faculty, with entering students (freshman and transfer) normally split evenly among the faculty. When students enter the program, they are assigned an advisor by the departmental office manager. In special circumstances, such as an unusually heavy service load, a faculty member is excused from undergraduate student advising. Special issues associated with advising are discussed at department meetings. Typical examples include approving petitions for specific requests, such as substituting one course for another or working on a special project as an elective course. UAF has a campus-wide advising center to which students are free to go. Some of our students go there initially, prior to deciding on ME as a major. Staff at the Academic Advising Center help students decide on a major and assist those students who are considering changing or reconfirming a major.

Monitoring Student Progress

The advising process described above facilitates the monitoring of the student's progress throughout the program. The advisor checks the student's progress each semester during

registration by having the student provide a standard checklist (see Table 5-1 and flowchart in the section for Criterion 5), on which courses already completed are listed so that both the student and advisor can see what remains to be taken. Before the student takes the FE exam during his or her final semester, this same checklist is used to make sure the student has completed 75% of the required courses. At the beginning of the 7th semester, students in two key classes (ME 441 and ME 302) are assessed by giving out ungraded exams to check on their knowledge of course prerequisites.

If the student withdraws from a class after the third Friday after the first day of instruction, a grade of W will appear on the student's academic record. The W grade does not affect the student's GPA. The last day a student can withdraw from a class is the ninth Friday after the first day of instruction. For a student to drop a course after the semester begins, both the advisor and the course instructor must sign a drop form.

Withdrawals after the last day for student-initiated withdrawals are allowed only in exceptional cases. Approval is not automatic, and students need to provide evidence to support their request. Students requesting late withdrawal must supply documentation in support of their request to the dean of the college or school in which the class is offered. Students must also obtain an add/drop form from the Registrar's Office and have the class instructor, department chair, and academic advisor sign the form before presenting it to the Dean.

Exceptions to the standard requirements are sometimes made on a case-by-case basis. Deviations from academic requirements and regulations for undergraduate students must be approved by academic petition. If a student submits a petition based on a disability, the coordinator of disability services will be consulted. A student may obtain petition forms from the Registrar's Office, and must return the forms to the Registrar's Office with the required signatures. There are three types of petitions:

1. **Core Curriculum Petitions**. If a student's petition deals with baccalaureate core requirements, it needs to be approved by the student's advisor and the head of the department of the academic area involved. The Registrar's Office will forward the petition to the chair of the core review committee for final approval.

2. **Major or Minor Degree Requirement Petitions.** If a student wishes to waive or substitute courses in the student's major or minor, the student will need the signatures of the advisor and of the department or program head of the student's major or minor area. The completed petition must be turned it to the Registrar's Office.

3. **Petitions for Other Requirements**. If a student's petition deals with general university and/or specific requirements for the student's degree or other academic policies, the student must obtain approval from the advisor and the dean or director of the college or school in which the major is located. The Registrar's Office will forward the petition to the Provost for final approval.

G. Transcripts of Recent Graduates

(Supplied separately.)

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

A. Mission Statement

UAF Mission Statement

The University of Alaska Fairbanks, as the nation's northernmost Land, Sea, and Space Grant university and international research center, advances and disseminates knowledge through creative teaching, research, and public service with an emphasis on Alaska, the North, and their diverse peoples.

CEM Mission Statement

The College of Engineering and Mines (CEM) at UAF advances and disseminates technical and scientific knowledge through creative teaching, research, and public service with an emphasis on Alaska and other high latitude regions. The College promotes students' self motivation to excel and guides them towards professional careers and entrepreneurship in an environment of life-long learning.

Department Mission Statement

The mission of the Mechanical Engineering Department at UAF is to offer the highest quality contemporary education at the undergraduate and graduate levels and to perform research appropriate to the technical needs of the State of Alaska, the nation, and the world.

B. Program Educational Objectives

The program educational objectives of the Mechanical Engineering Department are available on the department website at http://www.alaska.edu/uaf/cem/me/about/mission.xml.

After completing the Mechanical Engineering undergraduate program, students will be able to:

1. Compete successfully on the world stage at the professional level
2. Understand the significant local, regional, national, and global issues facing humankind
3. Continue to develop as engineers through lifelong learning
4. Serve as resources of technical knowledge for the state as well as the nation, especially with respect to extreme latitude issues.

C. Consistency of the Program Educational Objectives with the Mission of the Institution

Objectives 1 through 4 are consistent with the CEM and UAF Mission Statements, with item 4, in particular the northern emphasis, being a key part of all three missions. The Item 3 focus is on the importance of continuing education, whether it is self-taught or in a more formal setting. Lifelong learning is critical in a continually evolving field such as mechanical engineering.

D. Program Constituencies

Our constituencies include (1) our students, (2) employers of our students, (3) the ME Industrial Advisory Committee, (4) professional engineering societies, (5) faculty in other universities and at UAF where our graduates take graduate courses, and (6) the State of Alaska, which provides funding for the academic side of this program. The American Society of Mechanical Engineers, with both a student chapter on campus and a newly formed senior chapter in Fairbanks, is a key organization that provides representation for the constituency of practicing engineers.

The needs of each constituency are met through the program objectives. Engineering **students** need the tools to obtain a job and/or form a career for a successful and happy livelihood. An appreciation for lifelong learning is necessary for career advancement or even career change. The **employers** of our graduates need engineers with technical knowledge and skills in order to be competitive in either the marketplace or public service. Many employers hire students locally, but are often regional and global companies that require graduates with that wider understanding of global issues. The ME **Industrial Advisory Committee** is a representative body of the employers of our students and has similar needs. The success of **professional societies** hinges on their members and the knowledge and skills they bring to the profession. Our graduates have the general skills to be competitive and specific knowledge of engineering issues in extreme latitudes, which make them a particular asset for societies that develop and promote codes and standards (such as ASME and SAE). Our graduates will have the skills to go on to graduate and professional schools, thereby helping satisfy the needs of **faculty in other universities**. An appreciation for the need for lifelong learning is instrumental for success in postgraduate school. Finally, the State of Alaska needs engineers that compete both regionally and globally, and clearly needs graduates with additional expertise in extreme environments such as the Arctic.

E. Process for Revision of the Program Educational Objectives

Description of Process

The program educational objectives are evaluated every three years, on average. Input from the department's Industrial Advisory Committee (IAC) is taken during an on-campus meeting. Program educational objectives are discussed as a dedicated agenda item at this meeting.

Results and *Changes*

Changes in the wording of the 2nd and 4th educational objectives were recommended by the ME Industrial Advisory Committee, and approved by the ME faculty in a subsequent department meeting. In Objective 2, the word "deal with" was replaced with "understand," which the IAC felt better reflected a positive appreciation instead of simply coping with.

The words "high latitude" were substituted for "northern" in the 4th objective in recognition that the issues, concerns, and educational goals are not restricted to the Northern Hemisphere (e.g., cold winters, short/long days). This change was adopted in 2009 after discussion by the entire faculty in a department meeting concerning the relevance to our program's constituencies.

CRITERION 3. STUDENT OUTCOMES

A. Student Outcomes

Student outcomes are documented in two areas: on the department website and on every course syllabi distributed on the first day of classes. Our department has 12 student outcomes: the 11 EAC Criterion 3 outcomes, plus an additional outcome related to the unique education our department provides regarding engineering issues in extreme latitudes (i.e., northern issues). The department web page dedicated to ABET, which shows the student outcomes, is at http://www.alaska.edu/uaf/cem/me/about/abet.xml

The 12 student outcomes for the Mechanical Engineering Department are that graduates from our program must demonstrate the following:

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
d) an ability to function on multi-disciplinary teams
e) an ability to identify, formulate, and solve engineering problems
f) an understanding of professional ethical responsibility
g) an ability to communicate effectively
h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
i) a recognition of the need for, and an ability to engage in lifelong learning
j) a knowledge of contemporary issues
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
l) an appreciation of significant engineering issues in the North

All course syllabi (see Appendix A) list the particular student outcomes that a course will particularly help students achieve upon their completion of the program.

B. Relationship of Student Outcomes to Program Educational Objectives

The educational objectives are met through one or more of the student outcomes, as shown in the following table. This correlation was devised by comparing examples of each student outcome, and evaluating whether it clearly helped achieve a particular educational objective.

Outcome	Educational Objectives			
	1. Preparation	2. Understanding of Issues	3. Lifelong	4. Resource
a) Math, science	X			
b) Design experiment	X			
c) System design	X			X
d) Teamwork	X		X	
e) Problem solving	X	X	X	X
f) Ethics	X			
g) Communication	X	X	X	X
h) Broad education	X	X	X	X
i) Lifelong learning	X	X	X	
j) Current issues	X	X	X	X
k) Modern tools	X		X	X
l) Northern issues	X	X		X

CRITERION 4. CONTINUOUS IMPROVEMENT

A. Program Educational Objectives

Description and Frequency

Making continuous improvement in meeting *educational objectives* is approached using two different tools: (1) alumni and employer surveys and (2) input from our Industrial Advisory Committee (IAC). Surveys have been conducted every 3 years. However, after several cycles of anemic response rates, it was decided in 2010 to begin conducting surveys every 2 years. Input from the IAC is sought every 3 years during a 1-day on-campus meeting with the members.

The alumni survey questions are:

1. Do you feel that our program provided you with a solid engineering background?
2. Do you feel that you had a sufficient variety of electives to choose from?
3. Were the laboratory facilities adequate?
4. Were you satisfied with the math and science courses you took?
5. Were you satisfied with the humanities and social science courses?
6. Did we provide you with adequate design experience?
7. Did we provide you with sufficient practice in working as part of a team?
8. Did you have adequate exposure to oral and written communication?
9. What were the main strengths of our program?
10. What areas did you think were most in need of improvement?
11. Have you gone to graduate school and/or getting jobs found employment in Mechanical Engineering in general?
12. How many offers did you get for the graduate school and/or job?
13. Have you been involved in any important projects that involve significant local, regional or national issues?
14. Have you or do you hold or planned to get the FE, a PE or other professional license, or attend grad school, or other licensing?
15. Have you been asked to act as a resource of for Alaskan or other high latitude northern region related issues?
16. What semester/year did you graduate?

The employer survey questions are:

1. How many of our graduates have you hired since 2005?
2. How many are employed by you to present time?
3. At the beginning of the graduates' employment with you, were they able to make a significant contribution to your firm? (1-Strongly Agree; 2-Agree; 3-Neutral; 4-Disagree; 5-Strongly Disagree)

4. Were the graduates able to communicate effectively? (1-Strongly Agree; 2-Agree; 3-Neutral; 4-Disagree; 5-Strongly Disagree)
5. Were the graduates able to perform appropriate design calculations? (1-Strongly Agree; 2-Agree; 3-Neutral; 4-Disagree; 5-Strongly Disagree)
6. Were the graduates able to work effectively as part of a team? (1-Strongly Agree; 2-Agree; 3-Neutral; 4-Disagree; 5-Strongly Disagree)
7. What were the strongest points in the graduates you hired?
8. What do you see as areas in need of improvement?
9. Are your projects funded by the state or federal agencies?
10. Do the UAF graduates function as a resource of technical and/or engineering knowledge, particularly regarding cold-climate issues?

Expected Attainment

It is expected that the results from employer and alumni surveys will indicate a strong correlation with meeting the program's education objectives. Both surveys contain additional questions that do not directly address ABET educational objectives, but are used for other curriculum adjustments within the department. The following table shows the correlation between objectives and survey questions, and the expected results. Employer surveys are conducted on a scale of 1 (strongly agree) to 5 (strongly disagree). Alumni surveys are yes/no, and the expected result is the percentage of positive responses.

Educational Objective	Survey Question	Expected Result
1: Compete successfully on the world stage	Employer (#3): Do graduates contribute significantly at your firm?	≤2
2: Deal with local, regional and global issues	Alumni (#13): Are you involved in projects involving local or global issues?	60%
3: Develop through lifelong learning	Alumni (#14): Do you hold an FE, PE or other professional license?	60%
4: Serve as a technical resource with northern issues	Employer (#10): Do graduates function as a resource regarding cold-climate issues?	≤2

Continuous Improvement

Survey results are discussed in a department meeting after results have been compiled in the year the survey is conducted. Survey results are also given to the IAC during their on-campus visit. Possible actions for improvement in deficient areas include curriculum adjustment, elective course offerings, and non-credit seminars.

Summary of Results from 2007 Employer Surveys:

Distributed 4/6/2007
Due Date: 4/20/2007

Email: 13 sent, 1 returned
Mail: 3 sent, 2 returned
Total: 3 returned

Summary: For 20 hired graduates, most of them were able to make a significant contribution to the firms at the beginning of employment. They have good writing, speaking, and listening skills. The training in Thermodynamics and AutoCAD is a strong point. The major weakness is lack of prior training in a "real-world" or industrial environment.

Summary of Results from 2010 Employer Surveys:

Distributed 9/27/2010
Due Date: 11/1/2010

Mail: 4 sent, 1 returned

Summary: The employer is basically satisfied with the ME program and the student hired. Employers prefer students to have design training experience and real-world knowledge. In terms of the ABET outcomes, the employer's feedback showed that ME graduates can (1) compete successfully on the world stage at the professional level; and (4) serve as resources of technical knowledge for the state as well as the nation, especially with respect to northern issues. Due to the limited available feedback from the employers, it is difficult to assess the other two outcomes, that is, (2) deal with the significant local, regional, national, and global issues facing humankind, and (3) continue to develop as engineers through lifelong learning. A larger scope of employer survey is preferred in the future.

Summary of Results from 2007 Alumni Surveys:

Distributed 3/29/2007
Due Date: 4/17/2007

Email: 36 sent, 12 returned
Mail: 59 sent, 3 returned
Total: 15 returned

Strengths:

1. Solid engineering background.
2. Good training in communication.
3. Sufficient elective courses.

Weaknesses:

1. Inadequate design or industry experience, especially construction and HVAC, etc.
2. Some outdated lab facilities.
3. Insufficient exposure to internship and research.

Summary of Results from 2010 Alumni Surveys:

Distributed 9/27/2010
Due Date: 10/31/2010

Total: 86 sent, 13 returned

Summary: Graduates of the ME program are basically satisfied with it. In terms of the ABET outcomes, the graduates have shown that they are able to (1) compete successfully on the world stage at the professional level; (3) continue to develop as engineers through lifelong learning; and (4) serve as resources of technical knowledge for the state as well as the nation, especially with respect to northern issues. Based on the data received, graduates have not been capable of fully (2) dealing with the significant local, regional, national, and global issues facing humankind. A possible reason may be associated with the specific job responsibility of a new graduate. It is expected that as their careers proceed, graduates will have more opportunity to deal with significant issues facing humankind.

Summary of Results from Most Recent IAC Meeting

Notes form Industrial Advisory Committee (IAC)
Discussion Regarding ABET Educational Objectives
March 4, 2010

Attending from the Industrial Advisory Committee:
Burt Rosenbluth
Scott Bell
Jim Strandberg

The purpose of the meeting was to discuss primarily our ABET Educational Objectives with the IAC, and get their feedback on (1) whether they are still correct or need to be modified, and (2) their opinion on how the department can assess our success in meeting these objectives.

The emerging importance of renewable energy as a global issue was discussed, and how that topic in general terms could be included within the objectives.

Jim said he believes it is most important for the program to produce smart, bright students with the ability to do fundamental engineering work, and the particular details of a job can be taught later. In fact, sometimes a “blank slate” in that regard is better than any prior knowledge on a narrow topic.

Scott agreed that the easy part is teaching a particular job, the difficult part is generating a good work ethic is the student/employee does not already come with one. Therefore, the program should try to produce students with a good work ethic.

Jim said that most students lack “soft skills” such as communication, and not hard skills such as traditional engineering fundamentals.

Burt stressed the importance of working in teams because no project is ever a single effort, and there is a strong need to communicate well and effectively.

The discussion then focused more on the four specific Educational Objectives of the department.

Objective 1 – C*ompete successfully on the world stage at a professional level.*

Burt said that one way to assess this is whether students are going to grad school and/or getting jobs in Mechanical Engineering in general, not just in Alaska but also in other parts of the country or even world. He also stressed that any analysis of survey results needs to consider the economic conditions at the time the students graduated and we looking for work.

Jim said that students need to be "well rounded." Some criteria could be how many employers considered hiring the student. Were there several job offers, or were they difficult to come by. Jim also said that graduates should not be too industry specific (e.g., a particular company or type of company), but should be competitive in most Mechanical Engineering jobs.

Objective 2 – *Deal with the significant local, regional, national, and global issues facing humankind.*

Burt did not like the word "deal." It is too ambiguous. He preferred something like "understand." Jim agreed that "understand" was better than "deal," although Scott interpreted "deal" as a fine work because it indicates the ability to adjust. Scott did not object to changing to "understand," however.

Burt said that the breadth of senior design projects could indicate whether there is sufficient local, regional, national, and global reach in the program.

Scott asked whether students were involved in a range of projects in senior design. Dr. Sheng explained how the senior design projects are arrived at.

Jim stressed that engineers do not work in a vacuum, and again stressed that graduates need to be well rounded. He continued with an example: ASME has, in the past taken, a stance on nuclear energy, which is a national if not global issue. Discussion then moved to whether membership in professional societies is important for graduates. All 3 members agreed that there could be a range of reasons to be a member of a professional society such as ASME, and membership does not necessarily indicate any one particular ambition.

Objective 3 – *Continue to develop as engineers through lifelong learning*.

There was broad agreement that this objective is both clear and necessary. Assessing this objective should be fairly straightforward with surveys about FE, PE, grad school, or other licensing. Burt mentioned that it is possible to be a practicing engineer without a license. No further discussion occurred.

Objective 4 – *Serve as a resource of technical knowledge for the state as well as the nation, especially with respect to northern issues.*

Burt felt that program (faculty?) funding clearly indicates whether the department is a respected resource. (Does this reflect necessarily on the students?)

Jim stressed that being a state resource, for example, should not be done at the expense of being "well-rounded." The program should not over emphasize "northern issues" at the expense of more fundamental engineering education.

Employers can be surveyed "Are your employees acting as a resource?"

There was discussion about CE 603 – Arctic Engineering as a technical elective for undergraduates. This graduate-level course is not necessary for graduation, but is often taken, perhaps because it is required for an AK PE license. The IAC felt that this objective is being met if many students are taking CE 603.

Scott suggested that maybe "northern" should be changed to "high latitude," since the Southern Hemisphere can have the same technical challenges.

Documentation and Maintenance
Until 2007, alumni and employer surveys were mailed, and the responses were collected by the responsible faculty member. In the 2007 survey, both mail and email were used, and email responses were printed for a hard copy. The 2010 surveys were conducted entirely electronically, using an email response form. A hard copy of the responses will be printed. A summary of the surveys is compiled after collection, and the survey summary is distributed in the next faculty meeting.

B. Student Outcomes
Description and Frequency
Continuous improvement in meeting *student outcomes* is assessed using three tools: (1) the Faculty Course Assessment Report (FCAR) for all undergraduate courses, (2) end-of-program senior exit surveys, and (3) FE exam scores and sub-scores.

(1) *FCAR*
The FCAR is a method adapted from the Ohio Northern University Mechanical Engineering Department for quantitatively assessing courses in terms of student outcomes in a consistent and time-efficient manner. Faculty members prepare a FCAR for all undergraduate courses, required and elective, at the end of the course. An example FCAR is shown in Section D, and a hard copy of all FCARs for each course is included in the instructor/student work binders available for review during the visit. Each course assesses the corresponding student outcomes shown in the following table. For each of the assessed student outcomes in a particular course, the faculty member responsible for teaching that course develops concrete instruments for assessing whether students are able to meet that outcome. The assessment instruments vary by type of course (lecture, lab, etc.) and level (200, 300, or 400 level). For example, a tool for assessing outcome (e) may be a numerical engineering problem on a 400-level exam, while outcome (d) may involve a student's success in the capstone senior design course.

During the course, students are assessed as to whether they are meeting the criteria on a 4-point EAMU scale: **E**xcellent, **A**cceptable, **M**arginal, and **U**nacceptable.

Course	Outcome											
	a	b	c	d	e	f	g	H	i	j	k	l
ES101	x					x	x		x	x		x
ES201	x		x	x	x						x	
ES209	x				x						x	
ES210	x	x			x						x	
ES301	x								x			
ES307	x		x	x	x			x	x	x		
ES331	x				x				x		x	
ES341	x	x			x		x				x	
ES346	x				x		x	x			x	
ESM450	x		x	x	x	x	x	x	x	x	x	
ME302	x		x		x					x	x	
ME308	x	x		x	x		x		x		x	
ME313	x		x		x			x		x	x	
ME321	x	x		x								
ME334	x	x		x	x		x		x	x		x
ME401	x		x		x				x	x	x	
ME403	x		x		x				x	x	x	
ME404	x				x				x		x	
ME408	x		x	x	x		x		x			
ME409	x		x		x				x	x	x	
ME414	x		x		x	x	x				x	x
ME415	x	x					x			x	x	x
ME440												
ME441	x		x		x			x		x	x	x
ME450	x		x		x		x				x	
ME451	x		x		x						x	
ME452	x		x	x	x		x		x			
ME453	x		x		x					x	x	
ME458	x				x			x	x	x	x	
ME464	x	x			x		x		x			x
ME487	x		x	x	x	x	x		x		x	x

(2) <u>*Senior exit survey*</u>

The annual end-of-program senior exit survey has been used for many years in the Mechanical Engineering Department to obtain feedback of the program, apart from ABET criteria; survey questions are referred to as the *General Program Questions*. Starting in 2009, these General Program Questions, when appropriate, were linked to ABET criteria. Starting in 2008, a second set of survey questions addressing ABET outcomes was formulated; these are referred to as the *Outcomes Questions*. These two sets of survey questions have been refined over the years toward continuous improvement of the program. After written surveys have been conducted, a confidential oral survey is conducted so that students get a chance to elaborate on the written surveys including written comments. The results from the oral survey further assist the process of continuous improvements.

Some of the major refinements of the survey questions are discussed below.

11/16/2009 and 1/15/2010

During 11/16/2009 and 1/15/2010, both sets of survey questions were cross-linked with ABET criteria to discover whether any missing links were present; the gray cells of Table 4-1 indicate those questions that were appropriately linked to ABET criteria. A few broken links were found. Suggestions to fix the broken links by modifying the General Program Questions were given below:

1. Add a question about the adequateness of ES courses for preparing upper-level ME courses.
2. Add a question about the adequateness of ME laboratory facilities for learning.
3. Add a question about the adequateness of ME electives for learning.
4. Add a question about whether the computer programming in the ME/ES curriculum is adequate.
5. Add a question about whether the ASME student chapter is valuable.
6. Add a question about whether the FE exam is valuable.
7. Add a question about whether the student intends to take the PE exam in the future.
8. Add a question about the student's interest in pursuing postgraduate studies.

Revised questions are shown in Table 4-2.

March 25, 2010

In the department meeting, we talked about setting up some sort of metrics to quantify the results to "close the loop." One likely approach is to select one or two criteria for which the metrics will be established. For the related questions in the senior exit survey, we will be choosing a threshold. If a student's response to the specific question is below the threshold, then the student is asked to elaborate; if it is just under the question, about how we can improve in regard to this question. For example, to respond to the question "Your academic program provided you with the skills necessary to work with others as part of a team," we need to include the teamwork evaluation in the FCAR folders of the classes that have teamwork activities (e.g., ME 487 and ME 302/403). Professor Peterson also mentioned to add "modern tools" to respond to Criterion K. Examples of modern *tools* include software, hardware, and new fabrication processes such as microfluidics.

												Program Questions for Graduating Seniors [General Questions] 1. I was adequately exposed to Mechanical Engineering during my freshman year. 2. I was adequately exposed to Mechanical Engineering during my sophomore year. 3. The ES courses gave me adequate exposure to the Mechanical Engineering discipline. 4. The following ES courses adequately prepared me for upper-level ME courses: ___ES 101 ___ES 201 ___ES 301 ___ES 331 ___ES 341 ___ES 346 ___ES 307 5. Available ME electives are adequate and useful to me. 6. ME required courses are adequate and useful to me. 7. The Aero option is a valuable addition to the ME curriculum. 8. ME laboratory facilities are adequate. 9. ME lab-related courses are adequate. 10. The engineering/university computing facilities are adequate. 11. The integration of computer programming in the ME/ES curriculum is adequate. 12. ME 487 was a good way to integrate my course work into a design experience 13. Advising provided by ME faculty is adequate. 14. Advising provided by the Advising Center is adequate. 15. The ASME student chapter is valuable to me. 16. The taking of the FE exam now will be valuable to me in the future. 17. I intend to take the PE exam in the future. 18. I may be interested in going to graduate school in the near future.

a	b	c	d	e	f	g	h	i	j	k	l	**Outcomes Questions in ME Senior Survey**
1,2, 5,6, 7, 12				1,2, 5,6, 7, 12								(1) Your academic program provided you with knowledge of how to apply mathematical and scientific principles to engineering problems. [a, e]
	1,2, 5,6, 7, 12	1,2, 5,6, 7, 12		1,2, 5,6, 7, 12								(2) Your academic program provided you with the techniques needed to perform both analysis and design for engineering projects. [b, c, e]
			1,2, 5,6, 7, 12									(3) Your academic program provided you with the skills necessary to work with others as part of a team. [d]
							1,2, 5,6, 7, 12	1,2, 5,6,7, 12				(4) Your academic program provided you with knowledge of how engineering relates to the overall issues in today's society. [h, i]
												(5) Your academic program required you to demonstrate your skills in oral communication. [g]
												(6) Your academic program required you to demonstrate your skills in written communication. [g]
						12				12		(7) Your academic program required you to demonstrate your ability to communicate your ideas to engineers (technical audiences.) [g, k]
						12						(8) Your academic program required you to demonstrate your ability to communicate your ideas to non-technical audiences. [g]
						10				10		(9) Your academic program provided you with the ability to effectively use computers for communication (e.g. report writing, e-mail correspondence, web access.)

												[g, k]
												(10) Your academic program provided you with the ability to effectively use computers for analysis of data and engineering problem solving. [k]
												(11) The ME faculty are available to answer my questions about course work, research, curriculum and related issues.
												(12) I found the laboratory equipment to be in good working order.
3,	3,8, 9,			3,	15 ,	15 ,		3,15,16, 17,18	3,15	3,11, 13	18	Broken links between Table 4-1 and Table 4-2

Table 4-1: General Program Questions and Outcomes Questions Cross-linked to ABET Criteria Showing Broken Links

Table 4-2: Updated Survey Questions Cross-linked to ABET Criteria, April 2010

a	b	c	d	e	f	g	h	i	j	k	l	**Program Questions for Graduating Seniors [General Questions]**
												1. I was adequately exposed to Mechanical Engineering during my freshman year.
												2. I was adequately exposed to Mechanical Engineering during my sophomore year.
												3. The ES courses gave me adequate exposure to the Mechanical Engineering discipline.
												4. The following ES courses adequately prepared me for upper-level ME courses: ___ES 101___ES 201 ___ES 301 ___ES 331 ___ES 341 ___ES 346___ES 307
												5. Available ME electives are adequate and useful to me.
												6. ME required courses are adequate and useful to me.
												7. The Aero option is a valuable addition to the ME curriculum.

												8. The Petroleum option is a valuable addition to the ME curriculum.
												9. ME laboratory facilities are adequate.
												10. ME lab-related courses are adequate.
												11. The engineering/university computing facilities are adequate.
												12. The integration of computer programming in the ME/ES curriculum is adequate.
												13. ME 487 was a good way to integrate my course work into a design experience.
												14. Advising provided by ME faculty is adequate.
												15. Advising provided by the Advising Center is adequate..
												16. The ASME student chapter is valuable to me.
												17. The SAE student chapter is valuable to me.
												18. The taking of the FE exam now will be valuable to me in the future.
												19. I intend to take the PE exam in the future.
												20. I may be interested in going to graduate school in the near future.

(3) *FE exam*

All UAF-ME students are required to take the fundamentals of engineering (FE) examination in order to graduate, but they are not required to pass the examination. Based on past FE exam reports, UAF-ME students usually attend two different types of FE test: one is designed to test students' advanced knowledge in general engineering (e.g., advanced engineering mathematics, engineering probability and statistics), and the other is in mechanical engineering (e.g., mechanical design and analysis, materials and processing). Test subjects in the general engineering (GE) test are related to background knowledge, which supports the learning of discipline-specific knowledge (i.e., ME, CE, EE, etc.). The GE test, therefore, is not considered or mentioned here as a discipline-specific test.

On average, about one-third of UAF-ME students took the ME test and two-thirds took the GE test (table below), perhaps because most students were still taking ME classes when they took the test.

Distribution of UAF-ME Students Attending the ME and GE Tests

UAF-ME # of examinees	Oct 2006	April 2007	Oct 2007	April 2008	Oct 2008	April 2009	Oct 2009	April 2010	Oct 2010
ME	2	7	0	0	4	4	0	2	4
GE	1	1	2	8	1	10	8	12	0

Application of FE Exam Results:

According to an NCEES report written by Steven F. Barrett et al.,[1] the FE exam results can be used to assess particular aspects of the ABET criterion outcomes (a), (b), (c), (e), (f), and (k). However, no method was proposed in the report to directly and quantitatively correlate the FE exam results to the ABET outcomes, which could be due to a lack of data. The report also mentioned that discipline-specific test (e.g., ME test for ME students) results rather than the GE test results are preferred as a tool for monitoring and analyzing student learning performance in discipline-specific topic areas. The ME test covers 8 discipline-specific topic areas (i.e., mechanical design and analysis; kinematics, dynamics and vibration; materials and processing; measurement, instrumentation and control; thermodynamics and energy conversion processes; fluid mechanics and fluid machinery; heat transfer; refrigeration and HVAC). The results can then be used to determine which major courses offered by the department need to be improved or what modifications need to be made in the curriculum (e.g., change in instructor, textbook, teaching design, and teaching contents). One of the reasons for selecting discipline-specific (ME) test results rather than both ME test and GE test results for student-learning performance analysis is that test topic areas in the GE test are not directly relevant to ME-specific courses (as opposed to, say, Engineering Science courses, which are assessed using other tools). Courses that are ME-specific are usually taught only by ME faculty members who are in charge of the courses and can effectively modify the teaching of those courses. According to the table, data obtained from the test administrations of October 2006, April 2007, October 2008, April 2009, April 2010, and

[1] S. F. Barrett, E. W. LeFevre, J. W. Steadman, J. S. Tietjen, K. R. White, and D. L. Shitman,"Using the Fundamentals of Engineering (FE) Examination as an Outcomes Assessment Tool," June 2010, NCEES.

October 2010 include ME test results of UAF-ME students and will be used for student performance analysis.

For the proper use of the FE exam as a student-performance evaluation tool, the department needs to pre-define the topics that are taught as well as the level of depth and breadth of these topics. The relevant portions of the FE exam will then be used to assess students' knowledge in specific areas (e.g., for heat transfer, the relevant portion of the FE exam is the test results related to heat transfer problems). The evaluation results will be used to determine the courses that may need improvement based on defined criteria. In addition to the required courses that all students need to take, the department has two optional emphases: aerospace engineering and petroleum engineering, both of which require additional electives to satisfy the requirements of the emphases. Student learning performance for topics related to these two emphases may be better due to additional exposure to these topics. Required courses for the aerospace engineering emphasis include theory of flight, aerodynamics, introduction to astrodynamics, and propulsion systems. Required courses for the petroleum engineering emphasis include controls and design of mechanical equipment for the petroleum industry. Due to a lack of variety in the offering of ME electives, many students also take courses offered to satisfy the requirements of emphases without declaring an emphasis. These courses are related to the following ME test topic areas: mechanical design and analysis; thermodynamics and energy conversion processes; and fluid mechanics and fluid machinery. Therefore, the performance of our students is expected to be better in the three ME test topic areas mentioned above than others.

To analyze student performance using FE results, three methods were proposed in the report by Barrett et al.; they include Percentage-Correct Method, Ratio Method, and Scaled-Score Method. The Percentage-Correct Method may produce unrealistic and perhaps unobtainable expectations for student performance. The Scaled-Score Method uses the level of statistical uncertainty as a metric and assumes that the standard deviation of the national FE passing rate can be substituted for the institution's (i.e., UAF-ME) standard deviation. This method is not appropriate for our program due to the low number of UAF-ME students who take the ME tests (6 students for 2010, 4 for 2009, 4 for 2008, 7 for 2007, 2 for 2006 Oct.). Therefore, only the Ratio Method is used here.

Expected Attainment

(1) The quantitative level of attainment for each FCAR outcome tool is determined by the faculty member currently responsible for the course; however, a general attainment goal was agreed upon by the faculty in 2009 to act as a guide in the early development of this method. Using the EAMU vector, the goal is 30/40/20/10 percent of the students. For example, 30% of the students should rank excellent, 40%, acceptable, etc. Faculty members agreed, however, that these numbers should only act as a guide, and should be particularly adjustable for small courses with fewer than 10 students.

(2) For senior exit survey results, the initial threshold used for each of the survey questions is 50% of the total range of the score. For example, if the total score range is 3, then the threshold is 1.5. For any question where the threshold is exceeded, attempts will be made to ascertain possible reasons why, and whether improvements need to be made.

(3) For the FE assessment tool, the Ratio Scale Analysis Method is used according to the following steps:

A. Calculate the ratio of the average % correct rate of the students to the national rate for each topic area. The results for the October 2006 test are shown in the following table:

2006 Test. Descipline-specific test	**UAF-ME**			
Currently enrolled students				
	UAF-ME		National-ME	
Examinees Taking	2		788	
Examinees Passing	2		635	
Examinees Passing %	100		81	
PM Subject (ME discipline)		UAF Avg % correct	National AVG % correct	Ratio*
Mechanical Design and Analysis	9	61	45	1.355556
Kinematics, Dynamics, and Vibrations	9	61	51	1.196078
Materials and Processing	6	83	63	1.31746
Measurements, Instrumentation, and Controls	6	92	66	1.393939
Thermodynamics and Energy Conversion Processes	9	83	62	1.33871
Fluid Mechanics and Fluid Machinery	9	89	58	1.534483
Heat Transfer	6	33	39	0.846154
Refrigeration and HVAC	6	33	53	0.622642

* Ratio is the ratio of UAF-ME AVG % correct to National-ME AVG % correct

B. Perform similar calculations for all received test results (from 2006 to 2010). Since it is more informative to plot the performance (i.e., % correct ratio) on individual topic areas over time, the % correct ratios are calculated for all received ME test results (from 2006 to 2010). Because no UAF-ME students attended the ME tests in October 2007, April 2008, and October 2009; no test reports were received for those tests. In order to make a continuous and smooth performance plot for each of the topic areas over time, it is advisable to use yearly average ratios (by number of students) for the plot. The yearly performance ratios calculated for all topic areas from 2006 to 2010 are shown in the next table:

% Correction Ratios from 2006 to 2010

	2006	2007	2008	2009	2010
PM Subject	Ratio*	Ratio*	Ratio*	Ratio*	Ratio*
Mechanical Design and Analysis	1.355556	1.057143	0.886792	1.22807	0.876456
Kinematics, Dynamics, and Vibrations	1.196078	1.044118	1.204082	1.190476	1.098384
Materials and Processing	1.31746	0.978261	1.209677	0.816901	1.015901
Measurements, Instrumentation, and Controls	1.393939	1.086957	0.821429	1.222222	1.131448
Thermodynamics and Energy Conversion Processes	1.33871	1.113636	1.293103	1.115385	1.350137
Fluid Mechanics and Fluid Machinery	1.534483	1.068966	0.966667	1.458333	0.971965
Heat Transfer	0.846154	1.021277	0.857143	1.338462	0.811331
Refrigeration and HVAC	0.622642	1.1875	1.47619	1.317073	0.92955
Reference Normal	1	1	1	1	1
Reference High	1.05	1.05	1.05	1.05	1.05

* Ratio = UAF % correct /National % Correct

C. Determine the appropriate expectation of the student performance for each topic area. Among the eight topic areas, three of them (mechanical design and analysis; thermodynamics and energy conversion processes; and fluid mechanics and fluid machinery) are considered more closely related to the UAF Mechanical Engineering program emphases. UAF-ME students are expected to perform better in these three topic areas than the other topic areas. The expectation of the % correct ratios for these three topic areas was determined by the faculty as 1.05. In other words, the acceptable % correct ratio of UAF students is 1.05 or higher. The expectation of the % correct ratios for the other topic areas is defined as 1.

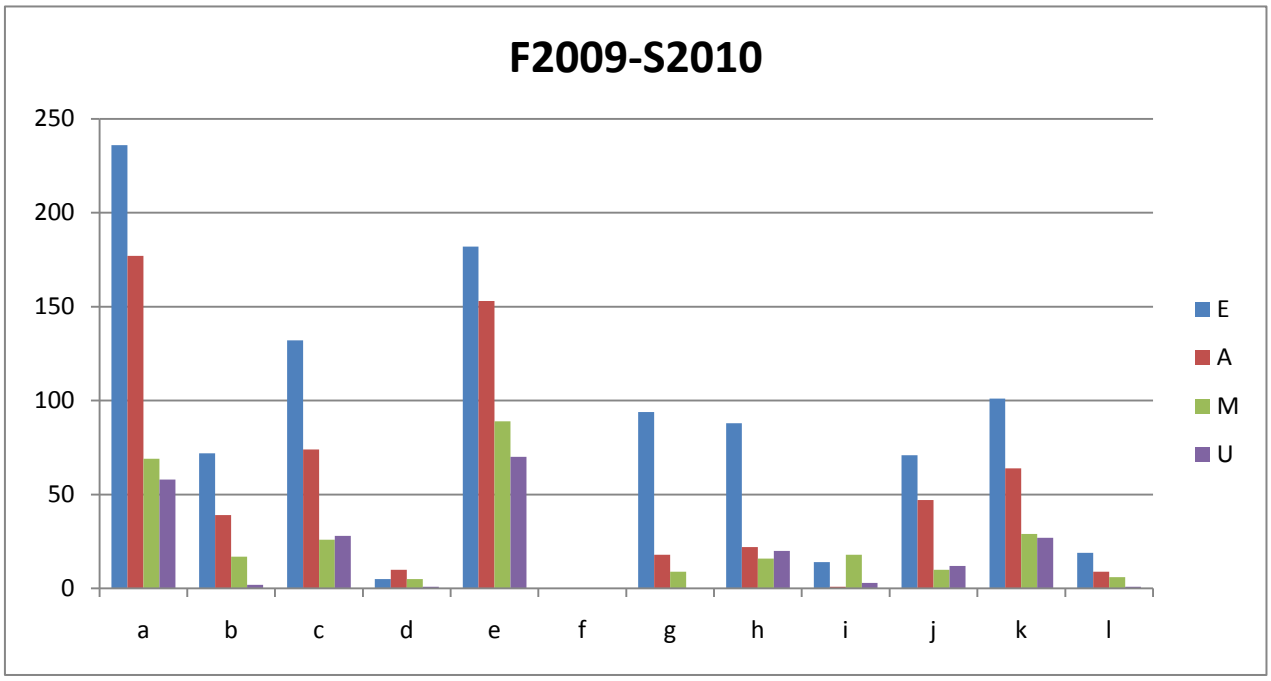
D. Plot yearly % correct ratios versus expectation over time for each of the topic areas. These results are shown and discussed in the Summary of Results section below.

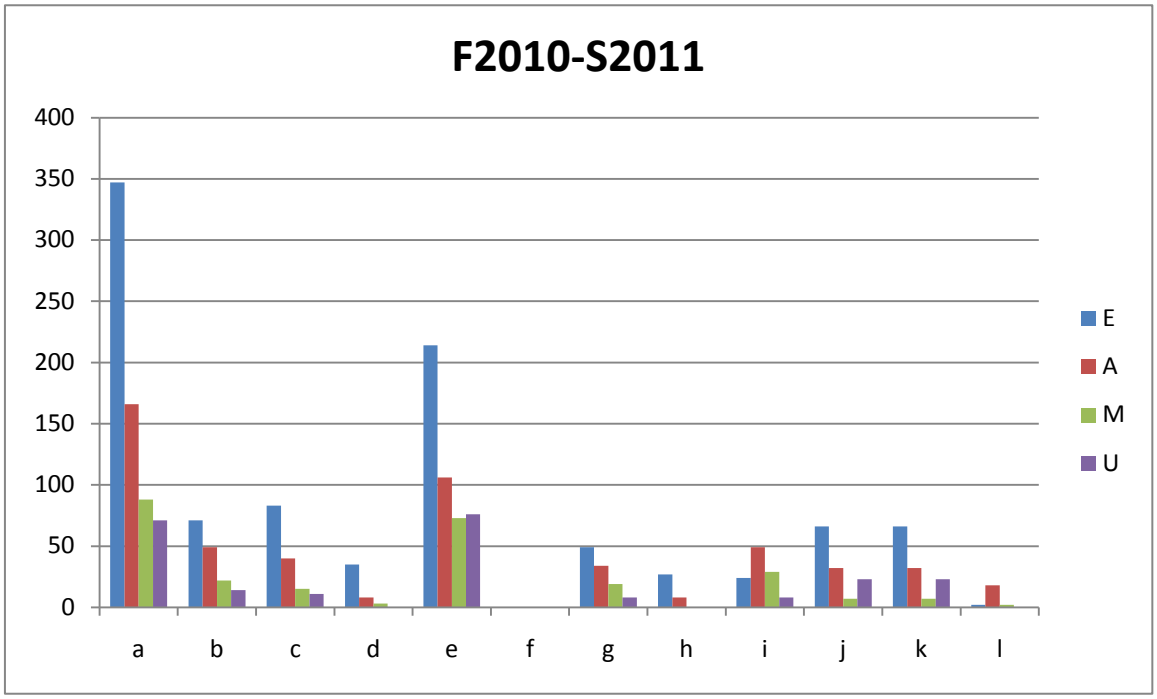
Summary of Results

(1) A summary of student outcome assessment using the FCAR for the past two academic years is shown in the table below, followed by the percent change between the two years. The number of assessment tools between academic years varies slightly due both to the instructor's changes to the FCAR and to elective courses that are only offered every other year. The number of tools varies widely between different outcomes, however, because some outcomes are difficult to quantify; most notably outcomes (d), (f), and (i). Many of the assessment tools for these outcomes are qualitative, particularly outcome (f), and an instructor's comments are included on the FCAR instead of given numeric values.

Bar graphs for each outcome for the same two academic years follow the table of student outcome assessment using the FCAR, and give a visual representation of the distribution within the EAMU vectors.

outcome	Tools	Fall 2009 – Spring 2010					Tools	Fall 2010 – Spring 2011					Change			
		E	A	M	U	Total		E	A	M	U	Total	E	A	M	U
a	29	236	177	69	58	540	30	347	166	88	71	672	-7.9	8.1	-0.3	0.2
b	6	72	39	17	2	130	6	71	49	22	14	156	9.9	-1.4	-1.0	-7.4
c	14	132	74	26	28	260	7	83	40	15	11	149	-4.9	1.6	-0.1	3.4
d	1	5	10	5	1	21	2	35	8	3	0	46	-52.8	30.2	17.3	4.8
e	24	182	153	89	70	494	21	214	106	73	76	469	-8.8	8.4	2.5	-2.0
f	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A
g	4	94	18	9	0	121	4	49	34	19	8	110	33.1	-16.0	-9.9	-7.3
h	6	88	22	16	20	146	3	27	8	0	0	35	16.9	-7.8	11.0	13.7
i	2	14	1	18	3	36	5	24	49	29	8	110	17.1	-41.8	23.6	1.1
j	8	71	47	10	12	140	7	66	32	7	23	128	-0.9	8.6	1.7	-9.4
k	10	101	64	29	27	221	15	66	32	7	23	128	-5.9	4.0	7.7	-5.8
l	2	19	9	6	1	35	1	2	18	2	0	22	45.2	-56.1	8.0	2.9





(2) Tabulated results for the general program questions, outcomes questions, and Engineering Science (ES) classes are shown in Tables 4-3 to 4-5. Summaries of results, changes, and potential issues for those questions directly related to ABET outcomes are shown in Tables 4-6 to 4-8. Although results fluctuate over the years, one can see improvements from 2010 to 2011, which indicates that some of the continuous improvements made have been effective. It takes time for effects of changes to be seen. Students generally have a favorable view of the usefulness of ES courses.

Table 4-3: Tabulated Results for General Program Questions

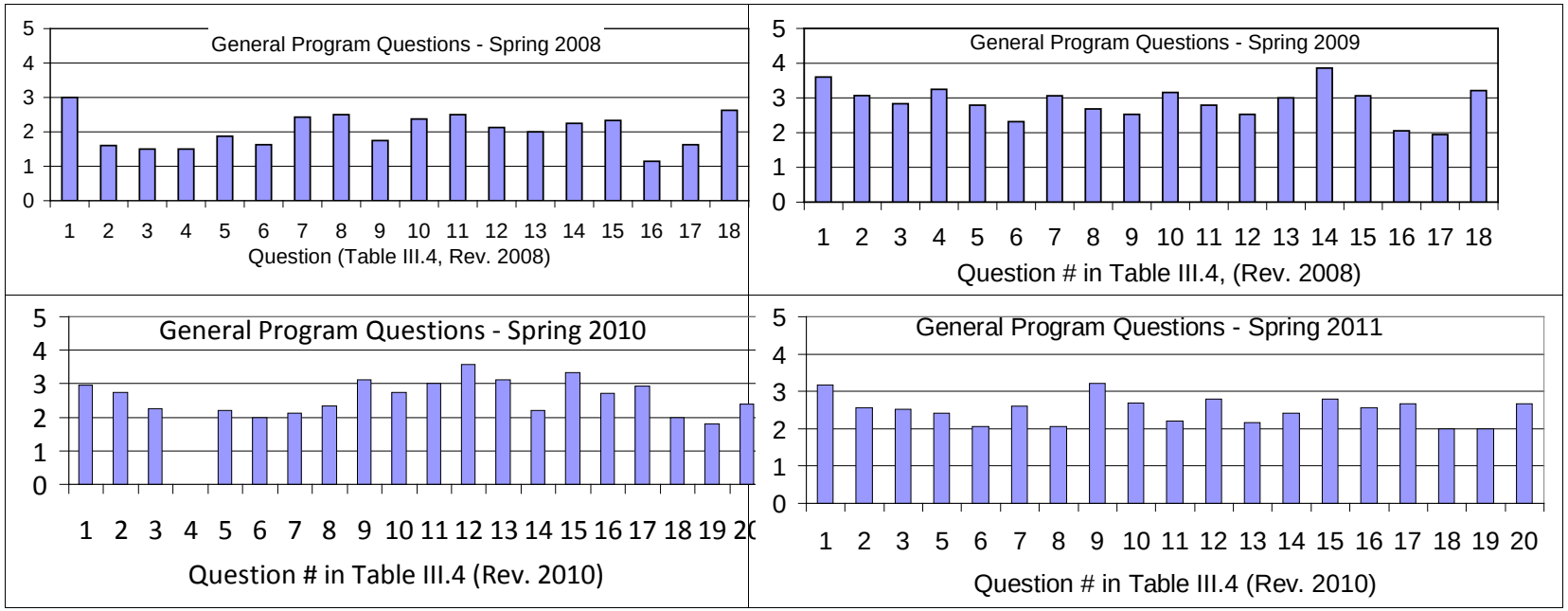


Table 4-4: Tabulated Results for Outcomes Questions

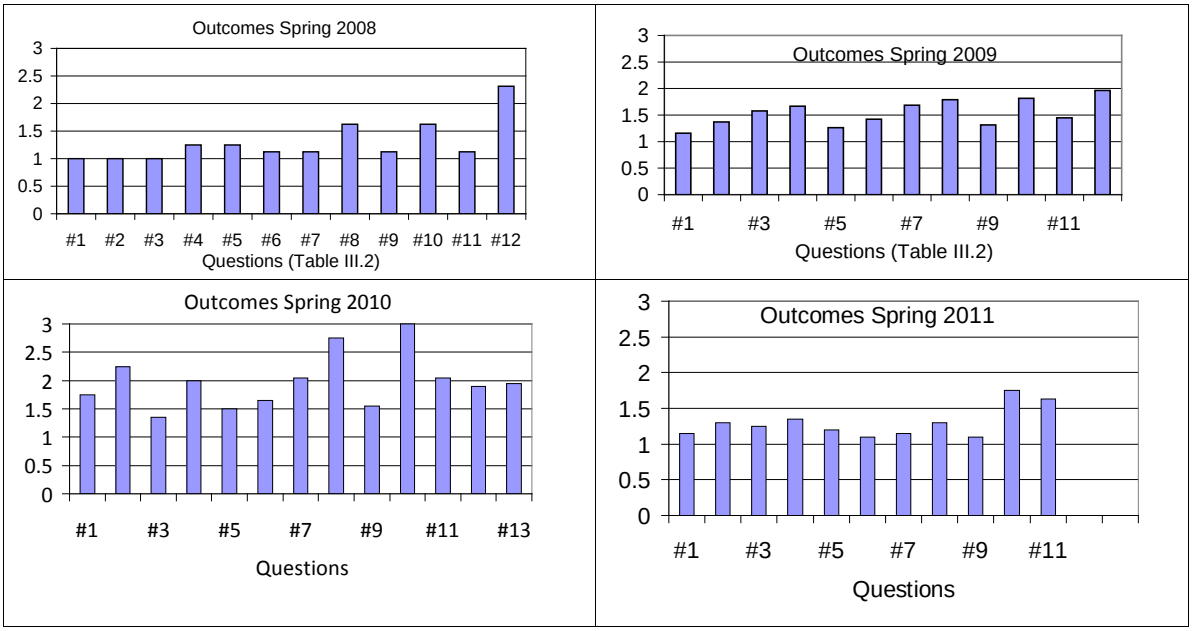


Table 4-5: Tabulated Results for Engineering Science Classes

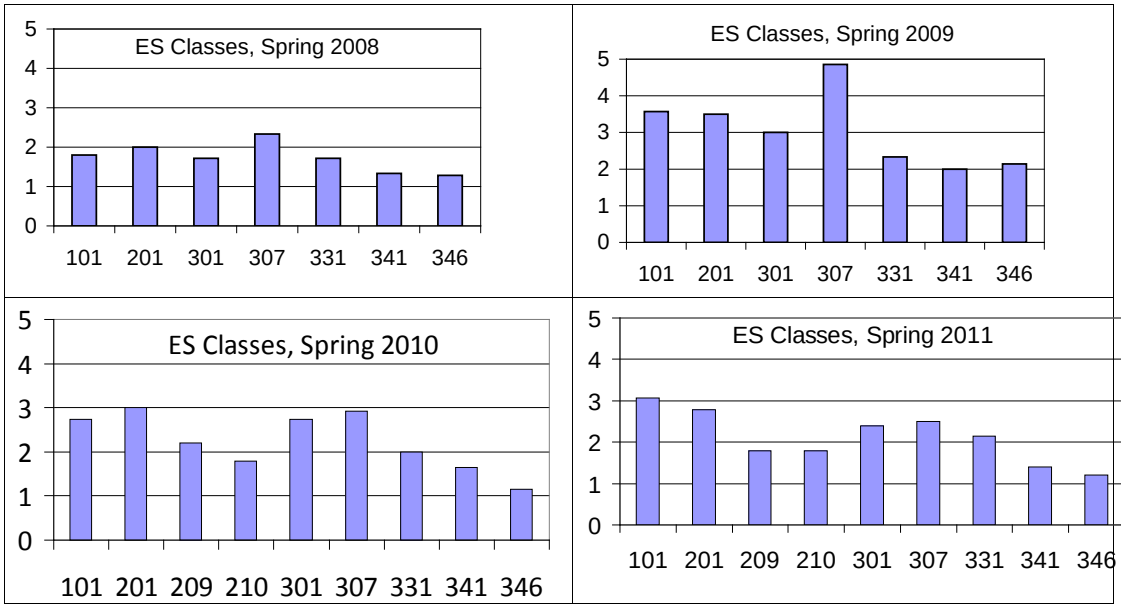


Table 4-6: Summary of Results, Changes, and Issues for General Program Questions

Question	ABET Criteria	Results	Changes	Reflections	Notes
I was adequately exposed to Mechanical Engineering during my freshman year.	a,b,c,d,e,h,i	Students felt not enough exposure since ES101's the only class they take that has an ME component; also, some are transfer students.	None	Encourage freshmen students to participate in student chapters such as ASME and SAE might be helpful.	
I was adequately exposed to Mechanical Engineering during my sophomore year.	a,b,c,d,e,h,i	Students felt not enough exposure since ME faculty members seldom teach ES classes during students' sophomore year.	None	ES classes are taught by several departments; the assignments of instructors are by tradition or availability of instructors. Better coordination might be helpful.	
The ES courses gave me adequate exposure to the Mechanical Engineering discipline.	a,b,c,d,e,h,i	Except for 2009, most students are satisfied with ES classes despite the fact that few ES courses are taught by ME faculty member.	None		
Available ME electives are adequate and useful to me.	a,b,c,d,e,h,i	Except for 2009, most students are satisfied with ME electives.	1. Many new elective courses were offered was the main reason of the satisfaction. These include: ME401 (2007), ME440 (2008), ME493 nanofluids (2008), ME493 Sustainable energy systems (2009) 2. ME 401 is being split into two courses to give students more options.	None	
ME required courses are adequate and useful to me.	a,b,c,d,e,h,i	Students are universally satisfied with ME required courses.	None	None	

The Aero option is a valuable addition to the ME curriculum.	a,b,c,d,e,h,i	Students' opinions vary slightly from year-to-year.	Consideration of a potential student chapter in Aerospace from SAE or AIAA is underway in 2011.	None	
The Petroleum option is a valuable addition to the ME curriculum.	a,b,c,d,e,h,i	Students' are satisfied with the Petroleum option.	More specific course requirements will be proposed for the option in Fall 2011 to enhance the option.	None	This question (#8) was new in 2010.
ME laboratory facilities are adequate.	b,c	Students are generally dissatisfied and the level of dissatisfaction has increased.	Laboratory and machine shop equipment were upgraded every year including necessary specialized software when needed. A new faculty member was hired with a motivated TA in 2010 to address the issues of ME415 lab.	This is basically an infrastructure issue: 1. A lack of laboratory and machine shop staff has made the upkeep of the equipment difficult. It's proposed to have Professor Ed Bargar to fill part of the role of laboratory staff, and to hire permanently the part-time machine shop staff. 2. Although there's constant upgrade of the laboratory and machine shop equipment, there is not enough budget and personnel to do an adequate job. The budget and personnel planning in this respect at the College level is poor. 3. With almost double the student enrollment in the department in recent years, lack of lab space becomes a significant issue with no near-term solution in sight.	This is question #8 in the 2008 revision, and #9 in the 2010 revision of the questionnaire.

				4. With the increase of student enrollment over the past few years, the budget for the number of Teaching Assistants still remains the same; another serious issue.	
ME lab-related courses are adequate.	b,c	Although the trend of student satisfaction of this question is similar to the previous one about laboratory facilities, satisfaction level is higher for this question than the previous one.	In addition to the changes described for the previous question on lab facilities, we have 1. added new laboratory in ME440 2. Hired a part-time machine shop technician which has greatly enhanced student satisfaction.	Same as descriptions for the previous question on lab facilities.	This is question #9 in the 2008 revision, and #10 in the 2010 revision of the questionnaire.
The engineering/university computing facilities are adequate.	g,k	Level of student satisfaction has increased from 2009 until now such that the scores are below the threshold.	A major upgrade of ME lab computers was done in 2008.	Same as descriptions for the previous question on lab facilities.	This is question #10 in the 2008 revision, and #11 in the 2010 revision of the questionnaire.
The integration of computer programming in the ME/ES curriculum is adequate.	g,k	Although the scores have improved from 2010 to 2011, they are still above the threshold.	Matlab has been used in ME409 and ME452 since 2010. There are discussions in the department about doing the same for other relevant courses.	None	This is question #11 in the 2008 revision, and #12in the 2010 revision of the questionnaire.

ME 487 was a good way to integrate my course work into a design experience.	a-e, g-i, k	Scores have been improved from 2010 to 2011 and are now below the threshold.	1. A slight change in the organization of this class from 2010 to 2011 led to the improvement. 2. Efforts starting Spring 2011 are underway to split the course into two to allow even better design experience.	None	This is question #12 in the 2008 revision, and #13 in the 2010 revision of the questionnaire.
The ASME student chapter is valuable to me.	d, f-g, i-j	Student satisfaction has improved but still above the threshold.	New ASME advisor was assigned in 2009.	None	This is question #15 in the 2008 revision, and #16 in the 2010 revision of the questionnaire.
The SAE student chapter is valuable to me.	d, f-g, i-j	Student satisfaction has improved and now below the threshold.	New SAE advisor in 2008 and strong leadership of SAE student chapter led to the improvement.	None	This is a new question (#17) added in 2010.
I intend to take the PE exam in the future.	i,j	Scores for this question are below the threshold.	None	None	This is question #17 in the 2008 revision, and #19 in the 2010 revision of the questionnaire.
I may be interested in going to graduate school in the near future.	i,j	Although the majority of the students are not interested in going to graduate school, more are interested in 2010 and 2011.	1. A B.S./M.S. fast track program was establi in 2009. 2. Stacked undergraduate/graduate courses were created ME440/640 (2008), ME493/693 nanofluids (2008), ME402/602 (2009) to provide more elective courses for undergraduate and graduate students.	None	This is question #18 in the 2008 revision, and #20 in the 2010 revision of the questionnaire.

Table 4-7: Summary of Results, Changes, and Issues for Outcomes Questions

Question	ABET Criteria	Results	Changes	Reflections	Notes
Your academic program provided you with knowledge of how to apply mathematical and scientific principles to engineering problems.	a,e	None are above the threshold.	None	None	
Your academic program provided you with the techniques needed to perform both analysis and design for engineering projects.	b, c, e	None are above the threshold.	None	None	
Your academic program provided you with the skills necessary to work with others as part of a team.	d	Except for year 2009, all scores are below the threshold.	None	None	
Your academic program provided you with knowledge of how engineering relates to the overall issues in today's society.	h,i	Except for year 2009, all scores are below the threshold.	None	None	

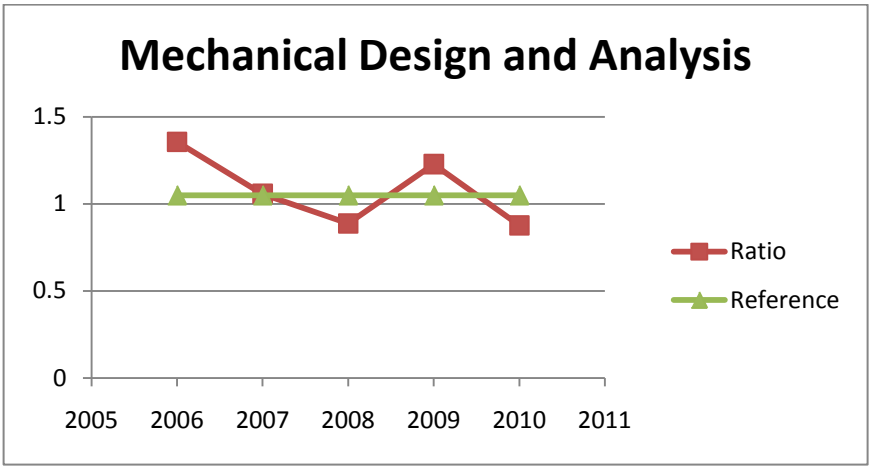
Your academic program required you to demonstrate your skills in oral communication.	g	Except for year 2009, all scores are below the threshold.	None	None	
Your academic program required you to demonstrate your skills in written communication.	g	None are above the threshold.	None	None	
Your academic program required you to demonstrate your ability to communicate your ideas to engineers (technical audiences.)	g,k	Except for year 2009, all scores are below the threshold.	None	None	
Your academic program required you to demonstrate your ability to communicate your ideas to non-technical audiences.	g	The scores have improved to be below threshold in 2011.	None	None	

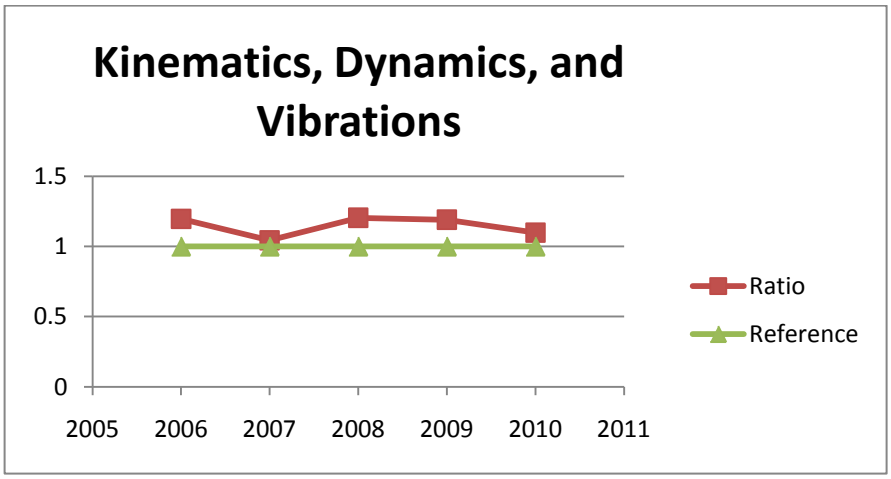
Your academic program provided you with the ability to effectively use computers for communication (e.g. report writing, e-mail correspondence, web access.)	g,k	None are above the threshold.	None	None	
Your academic program provided you with the ability to effectively use computers for analysis of data and engineering problem solving.	k	None are above the threshold.	None	None	
Your academic program provided you with an appreciation of significant engineering issues in the north.	l	The scores for these two years are above the threshold.	Discussions are underway regarding what courses are most appropriate to include discussions of northern issues.	None	Question #13 in 2010, and #11 in 2011.

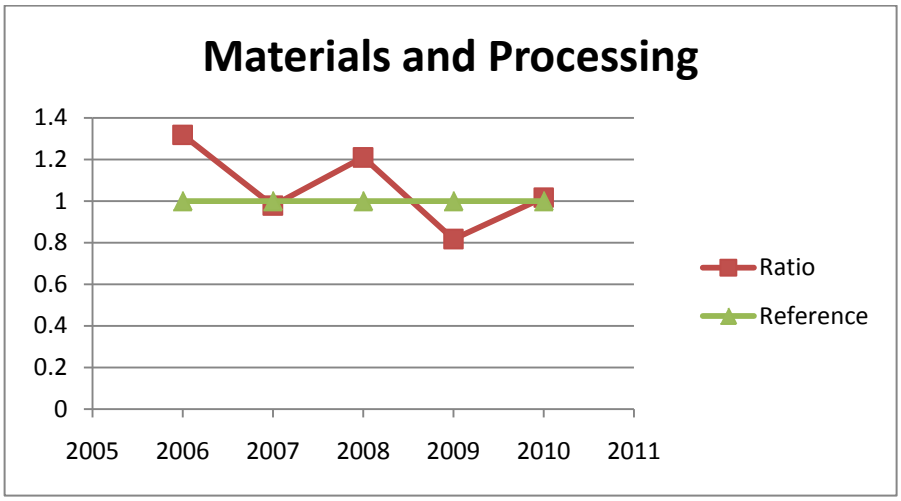
Table 4-8: Summary of Results, Changes, and Issues for Engineering Science Classes

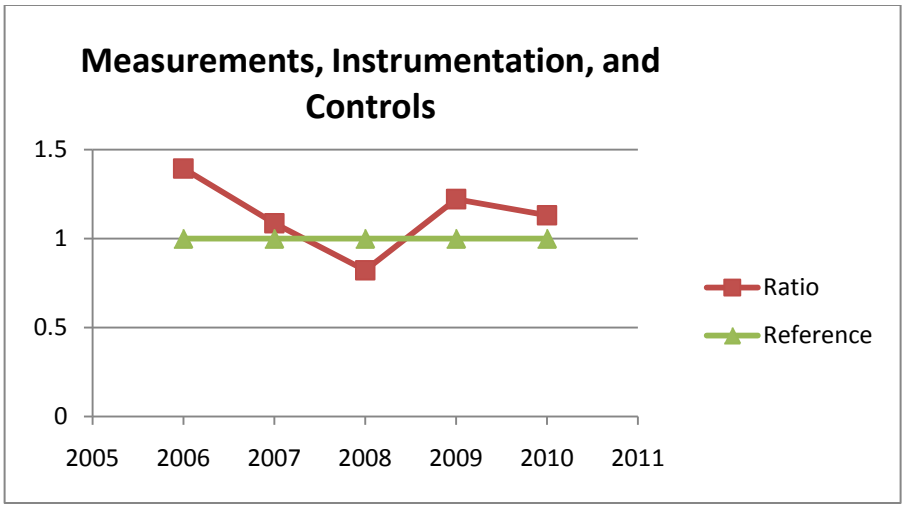
ES Course	ABET Criteria	Results	Changes	Reflections	Notes
ES101	a,b,c,d,e,h,i	Students are generally dissatisfied with this course which is joint-taught between ME, CEE and ECE departments.	For the ME portion, it's proposed to include components of Computer Aided Design into the course starting Fall 2011.	ES classes are taught by several departments; the assignments of instructors are by tradition or availability of instructors. Better coordination might be helpful.	
ES201	a,b,c,d,e,h,i	Students are generally dissatisfied with this course which is taught by instructors from different departments.	None	See above.	
ES209	a,b,c,d,e,h,i	Students are satisfied with this course.	None	None	
ES210	a,b,c,d,e,h,i	Students are satisfied with this course.	None	None	
ES301	a,b,c,d,e,h,i	Satisfaction of this course has improved since 2009.	None	None	
ES307	a,b,c,d,e,h,i	Satisfaction of this course has improved since 2011.		This course is usually taught by ECE department as a service course. It may be useful for Professor Ed Bargar, an ME faculty member, to teach it for better relevance.	
ES331	a,b,c,d,e,h,i	Students are satisfied with this course.	None	None	
ES341	a,b,c,d,e,h,i	Students are satisfied with this course.	None	None	
ES346	a,b,c,d,e,h,i	Students are satisfied with this course.	None	None	

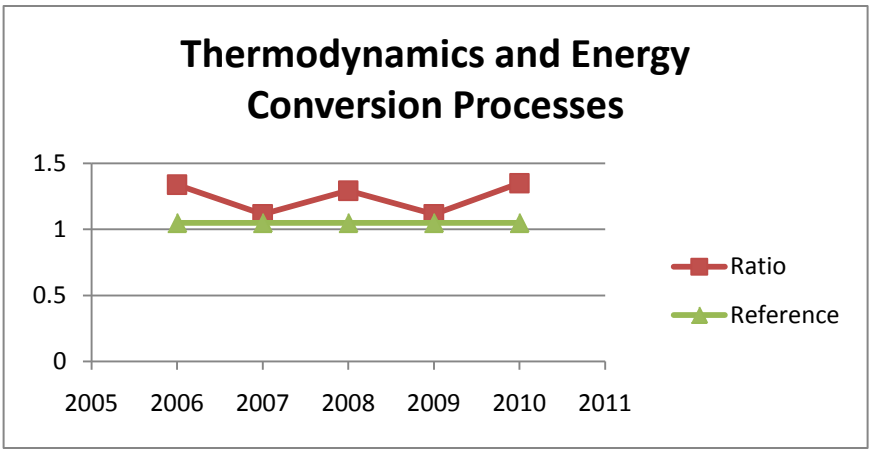
(3) FE Exam Results and Analysis:

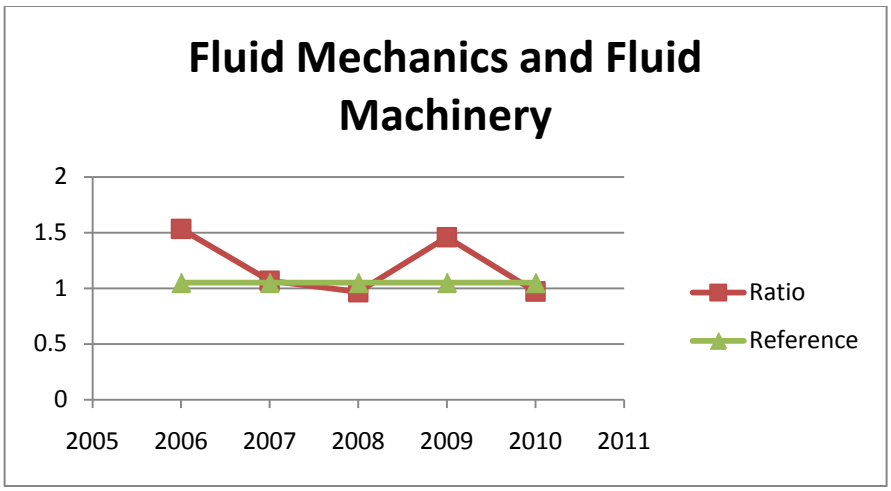


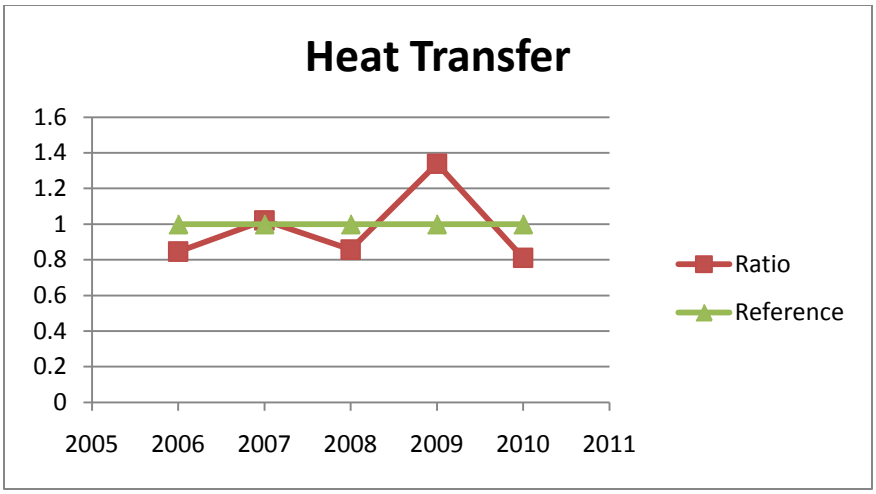


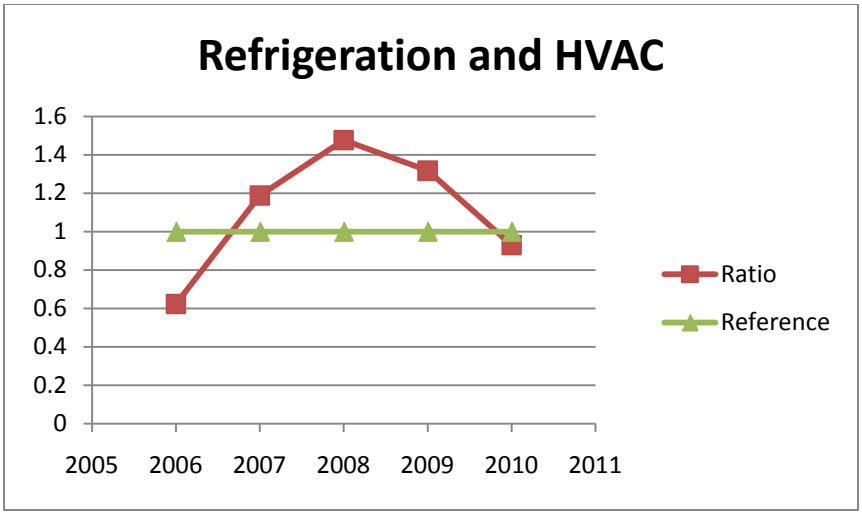



Measurements, Instrumentation, and Controls
1.5
1
0.5
0
2005
2006
2007
2008
2009
2010
2011
Ratio
Reference


Thermodynamics and Energy Conversion Processes
1.5
1
0.5
0
2005
2006
2007
2008
2009
2010
2011
Ratio
Reference


Fluid Mechanics and Fluid Machinery
2
1.5
1
0.5
0
2005
2006
2007
2008
2009
2010
2011
Ratio
Reference





The interpretation and recommended actions are as follows:

(a) For a specific topic area, if the performance (% correct ratio) is lower than expectation for two consecutive years, the topic area related courses need to be monitored for improvement. If the performance is lower than expected for three consecutive years, modifications need to be made to the curriculum.

Based on the data and figures shown above, the performance of ME students never falls below expectations for two consecutive years for all the test topic areas. Therefore, no modifications need to be made to the curriculum *based on the FE exam results*.

(b) For a specific topic area, if the long-term (3-year) average performance is lower than 90% of the expectation, the topic area related courses need to be monitored for improvement. If a 3-year average performance is lower than 80% of the expectation, modifications need to be made to the curriculum.

Based on the data and figures, the 3-year average performance never falls below 90% of our expectation for all the test topic areas. Therefore, no modifications need to be made to the curriculum *based on the FE exam results*.

(c) For a specific topic area, if the general trend of the performance is continuously decreasing and the fitted line drops to a level below 90% of expectation, the topic area related courses need to be monitored. If the general trend of performance is continuously decreasing and the fitted line drops to a level below 80% of the expectation, modifications need to be made to the curriculum.

Based on the data and figures, the only performance that shows a continuous decreasing trend is in the topic area of material and processing. Since the fitted line is still above 90% of expectation, no modifications need to be made to the curriculum *based on the FE exam results*.

In conclusion, based on the FE ME discipline-specific test results over the last four and a half years, the performance of UAF-ME students is considered satisfactory in all ME test topic areas. Besides the test topic area of heat transfer, the average performance of UAF-ME students is above expectations in all test topic areas. The average performance in heat transfer is 97.5% of the expectation.

Documentation and Maintenance

FE scores and sub-scores are collected by the department twice a year. All students in our program must take the FE in order to meet graduation requirements, and nearly all take it in either the fall or spring of their senior year. Results are sent to the department and analyzed by the responsible faculty member. Hard copies are archived.

Results from senior exit interviews are collected once a year. The results are summarized by the department chair and further analyzed by the faculty member responsible for the assessment of senior exit interviews. Electronic copies are archived by the responsible faculty member.

Electronic copies of all FCARs are collected by the ABET faculty coordinator at the end of each semester and copied onto external media, currently a CD or DVD. A common file-naming convention with the course number and semester is used. Binders containing examples of three students' work are collected every other year for use as supporting documentation, and as a guide for faculty new to a particular course. A hard copy of each FCAR is also placed in the front of each binder. For courses that are taught every semester, binders are collected every fourth semester, and for electives taught every other year, binders are collected every time the course is taught.

Each individual assessment tool for a particular course is identified on the FCAR, with a letter for the particular outcome and a number if more than one method/tool is used for that outcome. For example, b.2 is the second tool for assessing outcome (b). Tabs are then placed in the binders with these identifiers. Binders are stored in the department storage closet by year, and may be accessed and referenced by faculty members at any time. Therefore, when different faculty teach a course, they can use similar assessment metrics and tools.

C. Continuous Improvement

In order to assure steps are made towards continuous improvement on a regular basis, one entire department meeting each year is scheduled and devoted to addressing both program educational objectives, and student outcomes. These meetings are scheduled in January each year, just before the spring semester begins. At this time, faculty members are preparing for spring classes and making adjustments based on FCAR results from the last semester/year, and memories of the previous semester are fresh. This time is the best opportunity to discuss any substantive changes in overall success in meeting student outcomes, and the tables/charts (shown above) help by giving a quantitative measure. For example, between the 2009–10 and 2010–11 academic year, there was a -7.9% and +9.9% change in Excellent scores for outcomes (a) and (b), respectively, which is relatively small and not considered a major concern at this point. However, there was a -52% change in outcome (d) during the same time, principally because there are only two quantitative tools being used. Several outcomes are difficult to assess with quantitative tools, such as outcome (i), an appreciation for lifelong learning. In these instances, qualitative tools are documented in the FCAR and discussed in the meeting.

A summary of major results and changes from the past several annual meetings are shown in the table below. When faculty consensus is readily reached in a department meeting, an immediate change is usually implemented. When a ready consensus is not reached, a committee is established to investigate and provide a recommendation, upon which a vote will be taken.

Jan. 2011	• Some student outcomes have too many assessment tools (such as (a) and (e)). A more evenly weighted distribution of tools needs to be designed. An easy consensus was not possible, so a committee will need to be established. • A new degree emphasis in Mechanical Design will be investigated, and may help address an issue in senior exit surveys. • Outcome (h), economic, societal and global context, continues to prove difficult to assess quantitatively. Instructor comments will be included on FCAR when numeric scores are not possible.
Jan. 2010	• Senior exit survey – rewording some questions and added others to better match educational objectives • FCAR – establish a minimum of 1 assessment tool per outcome per class, and four tools per outcome for all classes. • Senior design ME487 – Stronger emphasis on interdisciplinary teams by encouraging “compartmentalizing” tasks. • Schedule IAC on-campus meeting for educational objectives

Jan. 2009	• Outcome (i) lifelong learning – Add stronger emphasis for certification and licensing besides FE exam. ME308 with LabVIEW certification is possible. • Outcome (f) ethics – We strongly rely on ESM450, but instructors our outside ME, limiting our ability to emphasis ME-specific issues. Try to add a section to ES101, and part of a ME487 lecture. • Objective 4 – technical value to state/nation. Create a Facebook group and encourage ME487 students to join before graduating.
Jan. 2008	• Check status of IAC membership and continuing interest. Possibly send out email survey regarding assessment of educational objective 4 (technical value to the state). • Student outcome (b) – Discussion of whether "doing" lab experiments doesn't always address "design". Try adding experimental design to ME308 and ME415 labs near the end of semester when students have larger base.

Changes to *program educational objectives* were most recently made after the March 2010 meeting with the IAC. All three members of the IAC felt the current objectives remained relevant and comprehensive. Some changes in wording were suggested for clarification. For example, the words "deal with" (Objective 2) were interpreted as too ambiguous and should be replaced with "understand." In addition, it was recommended that the word "northern" (Objective 4) be replaced with "extreme latitude."

The IAC was pressed to help the department improve the assessment of Objective 4 in terms of our graduates being a source of technical knowledge to the state, and particularly the nation. The IAC felt that continued employment within the state and outside the state were strong indicators. Therefore, improving alumni and employer survey responses is even more critical. There was discussion that social media (e.g., Facebook, LinkedIn) in addition to improved email surveys might be helpful.

The faculty discussed these wording changes in the next faculty meeting and agreed with the changes.

Continuous improvement in meeting *student outcomes* is addressed methodically and consistently on a course-by-course basis using results from FCARs. The final section of each FCAR is titled **Proposed Actions for Course Improvement**, where any actions the faculty member intends to implement next time are listed. Faculty members are encouraged to discuss these results and their ideas of addressing below-goal student achievement during the annual ABET department meetings in January. There is some difficulty, however, in convincing all faculty members to participate in an open discussion because of difficulty in separating *student outcome* assessment from individual faculty member *teaching* assessment. A summary of recent proposed actions from years 2009–2011 for each class according to each course FCAR is given in the following table:

ME308 Spring 2009	1. I will keep the textbook optional but provide a copy to the student study lounge where they will all have access to it as a reference. I will also strongly suggest buying it for anyone that feels textbooks have been fairly useful in the past. 2. The 1st half of the Human Power lab will carry more weight so individual groups must have their component working before going into the second week. I may also identify a group leader for each section that will be responsible for having each team ready on the 2nd day. Some compensation will be necessary for this leader, such as extra credit or allowed to drop homework assignment(s).
ES331 Fall 2009	1. Prepare more examples to practice in class. Slow down the lecture by writing notes on the whiteboard. Hand out the lecture notes in advance and ask students to preview the lecture contents. 2. Prepare more review examples for exercise.
ME321 Fall 2009	1. When possible, add additional lab sessions. However, it may be difficult given increasing enrollment. 2. Students may take ME 334 Elements of Materials Science in the same time with ME 321.
ME452 Fall 2009	1. Use more time to teach and demonstrate how to use Matlab for programming. This task should be started as early as possible in the semester. 2. Need to prepare more lecture slides in power point. 3. Give a short break before erasing the whiteboard.
ME441 Fall 2009	Require students pass a basic calculus proficiency exam administered by ME dept before taking ME 441 and other Sr year courses such as xxxyyy .
ME313 Spring 2010	Require each student getting less than a B in ES 346 [basic thermo] at UAF or transferring from UAA to pass a short prerequisite quiz before being allowed to take ES 313 [advanced thermo]. It is difficult to focus on the advanced concepts in 2nd semester thermodynamics when one third of the class lacks prerequisite knowledge.
ME408 Fall 2009	1. I will try to develop some animation of the vibrations to help students pick up the contents efficiently. 2. I will revise some contents to including more interesting problems.
ME334 Spring 2010	When possible, add additional lab sessions. However, it may be difficult given increasing enrollment and limited lab space.
ME440 Spring 2010	1. The instructor is preparing his own textbook by gradually establishing the lecture notes and homework. 2. The instructor will be looking into more applications in the conventional engineering practice such as in petroleum engineering, chemical engineering, etc.

ME487 Spring 2010	1. I will try to continue to introduce real project from industry, and make it to be mandatory, or give special credits to those students who would like to take industry projects. 2. I will revise some contents to including more interesting problems.
ES331 Fall 2010	1. Will add the formal discussion about how a load cell is designed, in order to integrate the learning of bending stress, strain gages, and deflection of beams. 2. Will cover the Energy Method in the future.
ES346 Fall 2010	See if there is a better way to streamline the quizzes. The TA helped me this year, but between us, we still made some mistakes. Students are surprisingly tolerant of these problems, but we should be able to fix them.
ME302 Fall 2010	1. The teaching materials will be reevaluated, with the goal to find time to cover more materials in applications. 2. More computer applications will be taught next time (i.e., SolidWorks/Motion and Simulation for moving part analysis, MATLAB for some homework problems). 3. Class notes will be posted online.
ME321 Fall 2010	1. I will make more clear about the time period and scope of the exams. 2. I will also coordinate with the lab instructor to make sure students' feedback is taken care of promptly.
ME408 Fall 2010	1. I will revise some contents to include more interesting problems. 2. Use new version textbook Mechanical Vibrations, 5th Ed, S. Rao, Prentice Hall, 2010.
ME409 Fall 2010	Prepare more Matlab programs for demonstrating the behavior of dynamic systems.
ME414 Fall 2010	Review to determine what sections can be shortened.
ME441 Fall 2010	Spend 1.5 hours on introduction to design optimization prior to extended (finned) surface heat transfer.
ME450 Fall 2010	1. The textbook is very useful for this course because many charts are heavily used throughout the course. So I would be best for every student to have a copy of the textbook for the course. 2. In-class demonstrations and experiments would be complementary to the lectures for the course. A guest lecture from a pilot on the flying experiences would also be interesting.
ME458 Fall 2010	1. Add at least 1 additional example to each class periods. 2. Use a final project instead of a final exam. There is not much engineering design in the course as it is now, but these students (seniors and graduates) surely have the ability to do some interesting design work. It might be necessary to pair EnvE students with ME students to make sure everyone has the proper background, so maybe group project instead.

ME308 Spring 2011	1. Either replace or change the rotational measurement lab. 2. Adjust some of the LabVIEW assignments or in-class examples to more closely resemble what some groups do in the Human Power lab. Then students can spend more time on the integration and team work. 3. Add a “Relevance” or “Like” type button to the homework assignments to gauge student perception as the course goes along.
ME313 Spring 2011	Find way to put (some) EES code on line in a regular manner. Adjust the syllabus to only cover the 1st half of compressible flow. Post all notes on-line after class.
ME334 Spring 2011	Additional fund is needed to buy additional lab equipment. When possible, add additional lab sessions. However it may be difficult given increasing enrollment and limited lab space.
ME401 Spring 2011	The first CAD class (in 2012) will cover more materials in fatigue design analysis, kinematic and dynamic analysis, fused deposition modeling, etc. The first CAM class (2013) will have more practice in computer-aided process planning, CNC programming, and machine tool operation.
ME403 Spring 2011	1. The teaching materials will be reevaluated. The goal is to cover more materials of machine components without decreasing the coverage of fundamental theories. 2. More SolidWorks/Simulation practice for both static and dynamic loading will be covered next time.
ME415 Spring 2011	1. Develop a lab report evaluation form which includes evaluation categories such as “precise, concise objective”, “reproducible experiment procedure”, “results in organized tables or graphs, etc. 2. Fill out lab report evaluation forms and include them when posting repot grades. 3. Replace old, inaccurate lab equipment.
ME440 Spring 2011	1. The instructor is preparing his own textbook by gradually establishing the lecture notes and homework. 2. The instructor is adding more applications and examples in the conventional engineering practice such as in petroleum engineering, chemical engineering, etc.
ME451 Spring 2011	Most of the students had a solid background from their experience in the general fluid mechanics course. So lecture time can be saved in reviewing fluid mechanics for other subjects.
ME487 Spring 2011	1. I will include more real design examples in lecture. 2. Continue encouraging students to undertake industrial projects.

D. **Additional Information – Example FCAR**

ME308 Measurement & Instrumentation Lab
Spring 2009

Catalog Description:
Measurement theory and concepts. Includes sensors, transducers and complete measurement systems; input, output and processing of engineering parameters; telemetry, data acquisition and logging and virtual instrument systems.

Course Textbook:
Theory and Design for Mechanical Measurement by Figliola & Beasley (recommended)
LabVIEW 8 Student Edition by R. Bishop (Recommended)

Grade Distribution:

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F	I	W	Total
0	4	5	4	6	2	1	3	0	0	0	0	1	0	0	26

Note: One student only completed approximately 1/3 of the assignments and did not take either final exam, and therefore failed the course.

Modifications Made to Course:

Two new lab exercises were introduced based on student feedback from the previous year, replacing two low-rated labs (Water Meter and Item Counting). The Wind Chime lab demonstrates FFT and introduces acoustic sound wave theory. The Marble Maze lab combines LabVIEW programming with accelerometer sensors.

LabVIEW was used extensively in labs of the 2nd half of the course. LabVIEW was covered in much more detail by devoting 1 lecture hour each week to the computer lab, and assigning a programming exercise each week.

A final two-week Human Power lab requires students to construct a cycle ergometer. In the first week lab groups work on a single sensor, and in the second week, all groups must combine their different instrumentation together into a single, unified LabVIEW VI.

The textbook was changed from *Required* to *Recommended* based on student feedback that it was of little help. The course notes were expanded with more tables and equations so the textbook was not required to do homework assignments.

Course Outcomes Assessment:

A. 1. Understand basic electrical theory behind the functioning of sensors (source, output, gain).

Sources: Question #8 on written Final Exam.
Results: EAMU vector: (10, 10, 6, 0)

B. 1. The design and implementation of an experiment, and data analysis by measuring the required warm-up time of a vehicle using a thermocouple in tailpipe. Experiment duration and sampling rate calculated by the student.

Sources: Lab Exercise 8 – Temperature Measurement.
Results: EAMU vector: (16, 10, 0, 0)

B. 2. Experimental data analysis to find the musical note associated with a length of wind chime, and comparison to acoustic theory.

Sources: Lab Exercise 7 – Wind Chimes.
Results: EAMU vector: (18, 4, 4, 0)

B. 3. Experimental data interpretation to discriminate alias frequency from true frequency, and calculate Nyquist frequency of a vibrating beam.

Sources: Lab Exercise 3 – Vibrational Frequency
Results: EAMU vector: (4, 10, 10, 2)

B. 4. The ability to design and conduct experiments is required in the Independent Lab, where students design and conduct their own experiment and present the data and conclusions.

Sources: Independent Lab
Results: EAMU vector: (7, 12, 7, 0)

D.1. Functioning on a multi-disciplinary team is required in the 2nd Human Power lab when four different lab groups working with different sensors must combine their individual instrumentation into a single, unified measurement system.

Source: Human Power Lab.
Results: EAMU vector: (6, 6, 8, 6)

E. 1. Identification, formulation, and solving of an engineering problem by designing an engineering solution to measuring the water level in a buried water tank in Fairbanks.

Sources: Question 10 on written final exam.
Results: EAMU vector: (22, 4, 0, 0)

G.1. The ability to communicate effectively is required in the 5-minute oral presentation of the Independent Lab, where students design and conduct their own experiment and present the data and conclusions.

Source: Independent Lab (slides on CDROM)
Results: EAMU vector: (20, 5, 1, 0)

I. 1. A recognition of the need to engage in lifelong learning is demonstrated by students that take the Certified LabVIEW Associate Developer

(CLAD) exam, giving them lifetime certification in an industry-standard engineering application. (Syllabus 2nd page)

Results: EAMU vector: (2, 0, 24, 0)

K.1. The use of modern engineering tools is done by introducing LabVIEW and requiring its use in the second half of the course when conducting all experiments. Programming exercises are assigned each week after covering a new software topic.

Source: LabVIEW Exercises # 1-10

Results: EAMU vector: (7, 7, 7, 5)

Student Feedback:

1. Most liked the in-depth LabVIEW and DAQ coverage, but felt the course work requirements were now equivalent to two courses, and simply too much work.

2. Many students felt the lecture was too fast and covered too much in the short amount of time (1 hour lecture a week). The course notes still had several bugs referring to the optional textbook that most students had not purchased.

Reflection:

1. There are assignments due three times a week: LabVIEW exercises, Lab exercises, and homework. I will probably either reduce the number of assignments by combining topics into a single assignment, or allow students to drop some lowest grades so they can skip some assignments when their other workload is particularly high.

2. The multi-disciplinary team requirement of the Human Power lab did not work out well, as the 2nd session work inevitably fell to the 2 or 3 most competent students, with the rest simply standing around and letting them fix problems and integrate the system.

Proposed Actions for Course Improvement:

1. I will keep the textbook optional but provide a copy to the student study lounge where they will all have access to it as a reference. I will also strongly suggest buying it for anyone that feels textbooks have been fairly useful in the past.

2. The 1st half of the Human Power lab will carry more weight so individual groups must have their component working before going into the second week. I may also identify a group leader for each section that will be responsible for having each team ready on the 2nd day. Some compensation will be necessary for this leader, such as extra credit or allowed to drop homework assignment(s).

CRITERION 5. CURRICULUM

A. Program Curriculum

The program curriculum for Mechanical Engineering is shown in Table 5-1.

1. The curriculum is the primary means by which the program educational objectives are achieved.

Objective 1 – Compete successfully at a professional level

The ME curriculum, through its required and elective courses, provides our students with a wide spectrum of core engineering knowledge including calculus, chemistry, mechanics, analytical and numerical analysis, thermodynamics, thermal sciences, and mechanical design. Higher-level courses can be sufficiently rigorous, supported by our prerequisite structure, which gives our graduates the tools to compete successfully nationwide.

Objective 2 – Understand significant local, regional, national, and global issues

An understanding and appreciation of these issues is apparent through both lecture-based and design courses. Junior (300-level) design courses incorporate real-world design problems and constraints. The capstone design course (ME 487) encourages students to take on industry-sponsored projects, where real-world significance is obvious.
Upper-division (300- and 400-level) lecture courses are strongly tied with engineering problems, design constraints, and approaches.

Objective 3 – Continue to develop through lifelong learning

The course content in our curriculum is flexible to constantly address current engineering issues. The wide breadth of background of the department's faculty members (despite its relatively small size) allows the program to have courses taught by faculty who are actively involved in their respective research areas. This helps our graduates realize the value of continually adapting and developing through continuous learning, both by formal education and on the job.

Objective 4 – Serve as a resource of technical knowledge, particularly with extreme-latitude issues.

The alignment between our curriculum and this objective is most apparent with the additional student outcome in our program: outcome (l) – an appreciation of significant engineering issues in the North. The strong ties between this outcome and our courses (see table in Criterion 3 Section B) demonstrates that seven of our courses have strong relevance to this outcome.

2. The course curriculum and the prerequisite structure support student outcomes by supplying and allowing for a methodical increase in rigor in each area. This approach is particularly apparent in the design courses, where each course relies heavily on the knowledge before, allowing for increased detail and engineering applicability.

Table 5-1: Curriculum

Program Name

	Course (Department, Number, Title) List all courses in the program by term starting with first term of first year and ending with the last term of the final year.	Indicate Whether Course is Required, Elective or a Selected Elective by an R, an E or an SE.[2]	*Curricular Area (Credit Hours)*				Last Two Terms the Course was Offered: Year and, Semester, or Quarter	Average Section Enrollment for the Last Two Terms the Course was Offered[1]
			Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Other		
Year 1 Fall	ENGL 211X or 213X – Academic Writing	R			3		F-2010 & S-2011	32
	ANTH 100X or ECON 100X or HIST 100X or ENG 100X	R			3		F-2010 & S-2011	20-110
	MATH 200X – Calculus I	R	4				F-2010 & S-2011	20
	ES101 – Introduction to Engineering	R		3			F-2010 & S-2011	35-Lec/12-Lab
	CHEM 105X – General Chemistry	R	4				F-2010 & S-2011	95-Lec/13-Lab
Year 1 Spring	COMM 131X or COMM 141X	R			3		F-2010 & S-2011	23
	ANTH 100X or ECON 100X or HIST 100X or ENG 100X	R			3		F-2010 & S-2011	20-110
	LS100X or LS101X – Library Sciences	R			1		F-2010 & S-2011	50
	MATH 201X – Calculus II	R	4				F-2010 & S-2011	33
	CHEM 106X – General Chemistry II	R	4				F-2010 & S-2011	110-Lec/16-Lab
	ES 201 – Computer Techniques	R		3			F-2010 & S-2011	25
Year 2 Fall	ENGL 211X or ENGL 213X – Academic Writing	R			3		F-2010 & S-2011	32
	ANTH 100X or ECON 100X or HIST 100X or ENG 100X	R			3		F-2010 & S-2011	20-110
	MATH 202X – Calculus III	R	4				F-2010 & S-2011	20
	PHYS 211X – General Physics I	R	4				F-2010 & S-2011	75-Lec/15-Lab
	ES209 – Statics	R		3			F-2010 & S-2011	33
	ME 321 – Industrial Processes	R		3			F-2009 & F-2010	40-Lec/9-Lab
	ANTH 100X or ECON 100X or HIST 100X or ENG 100X	R			3		F-2010 & S-2011	20-110
	MATH 302 – Differential Equations	R	3				F-2010 & S-2011	30

	PHYS 212X – General Physics II	R	4				F-2010 & S-2011	70-Lec/15-Lab
	ES 210 – Dynamics	R		3			F-2010 & S-2011	25
	ES 346 – Basic Thermodynamics	R		3			F-2010 & S-2011	33
Year 3 Fall	ART/MUS/THR 200X – Aesthetic Appreciation	R			3		F-2010 & S-2011	20-110
	Elective	E				2	F-2010 & S-2011	varies
	ES 301 – Engineering Analysis	R	1	2			F-2010 & S-2011	33
	ES 307 – Elements of Electrical Engineering	R		3			F-2010 & S-2011	41
	ES 331 – Mechanics of Materials	R		3			F-2010 & S-2011	24
	ME 302 – Dynamics of Machinery	R		4 (x)			F-2010 & S-2011	26-Lec/13-Lab
Year 3 Spring	Engineering 400-level Elective	SE		3			all	varies
	ME 308 – Instrumentation and Measurement Lab	R		3			S-2009 & S-2010	25-Lec/12-Lab
	ME 313 – Mechanical Engr. Thermodynamics	R		3			S-2009 & S-2010	24
	ES 341 – Fluid Mechanics	R		4			F-2010 & S-2011	42-Lec/9-Lab
	ME 334 – Materials Science Engineering	R		3			S-2009 & S-2010	24-Lec/12-Lab
Year 4 Fall	BA 323X or COMM or JUST or PS 300X or NRM 303X or PHIL 322X	R			3		F-2010 & S-2011	20-110
	Mechanical Engineering 400-level Elective	SE		3			F-2010 & S-2011	3-12 (9 avg.)
	ME 408 – Dynamics	R		3			F-2009 & F-2010	23
	ME 441 – Heat and Mass Transfer	R		3			F-2009 & F-2010	22
	ESM 450 – Engineering Economic Analysis	R		3			F-2010 & S-2011	33
Year 4 Spring	BA 323X or COMM or JUST or PS 300X or NRM 303X or PHIL 322X	R			3		F-2010 & S-2011	20-110
	Mechanical Engineering 400-level Elective	SE		3			F-2010 & S-2011	3-12 (9 avg.)
	ME 487 – Design Project	R		3 (x)			S-2010 & S-2011	22
	ME 403 – Machine Design	R		3 (x)			S-2010 & S-2011	20
	ME 415 – Thermal Systems Lab	R		3 (x)			S-2010 & S-2011	22-Lec/11-Lab
TOTALS-ABET BASIC-LEVEL REQUIREMENTS			32	70	31	2		
OVERALL TOTAL CREDIT HOURS FOR THE DEGREE								
PERCENT OF TOTAL			23.7%	51.9%	23.0%	1.5%		
Total must satisfy either credit hours or percentage	Minimum Semester Credit Hours		32 Hours	48 Hours				
	Minimum Percentage		25%	37.5 %				

1. For courses that include multiple elements (lecture, laboratory, recitation, etc.), indicate the average enrollment in each element.
2. Required courses are required of all students in the program, elective courses are optional for students, and selected electives are courses where students must take one or more courses from a specified group.

Instructional materials and student work verifying compliance with ABET criteria for the categories indicated above will be required during the campus visit.

3. A flowchart of the course curriculum for the ME program and associated prerequisites for each course is shown on the following page. This chart is available to our students on the department website; it is also available in the main department office. All faculty members serve as academic advisors, and make this course curriculum chart available to their advisees.

4. See the flowchart on the following page.

5. Our required curriculum exceeds minimum standards for engineering education in number of contact hours. Furthermore, our very low average student-to-faculty-member ratio of 15:1 allows for more direct student contact with instructors.

6. The major courses in mechanical engineering are taken during the final two years, with a total of 37 credits. These culminate in ME 487 (Senior Design), the capstone design course taken during the last semester of the senior year. In this course, students work individually or in teams to design an engineering device. Although one faculty member is responsible for this class, typically, all faculty members participate by advising individual students. Past examples of design projects include a thermoelectric waste heat generator, axial flux wind turbine, air/water shell-and-tube heat exchanger, touch screen architect desk, and microfluidic control gates.

In the Senior Design course, the curriculum is scheduled to deliver knowledge about the engineering design process (form a team, define a design problem, and make a proposal; find the design constraints and limitations; find alternative design solutions; prototype the design; and wrap up the design process with a final report and presentation). The course also provides students with practice in the assigned or chosen problem. Faculty discuss contemporary design and technology advances including the semiconductor photolithography process for IC fabrication, soft lithography, and MEMS technology for micro systems fabrication, reliability, etc. In the non-technical area, faculty cover issues like globalization, risk management, and teamwork. During non-lecture times, the class focuses more on direct interaction between faculty and students, for consultation regarding their project planning, interpersonal communication skills, project management skills, and presentation skills.

In one semester of design practice, students have to spend about 10 hours per week to be able to complete a notable project.

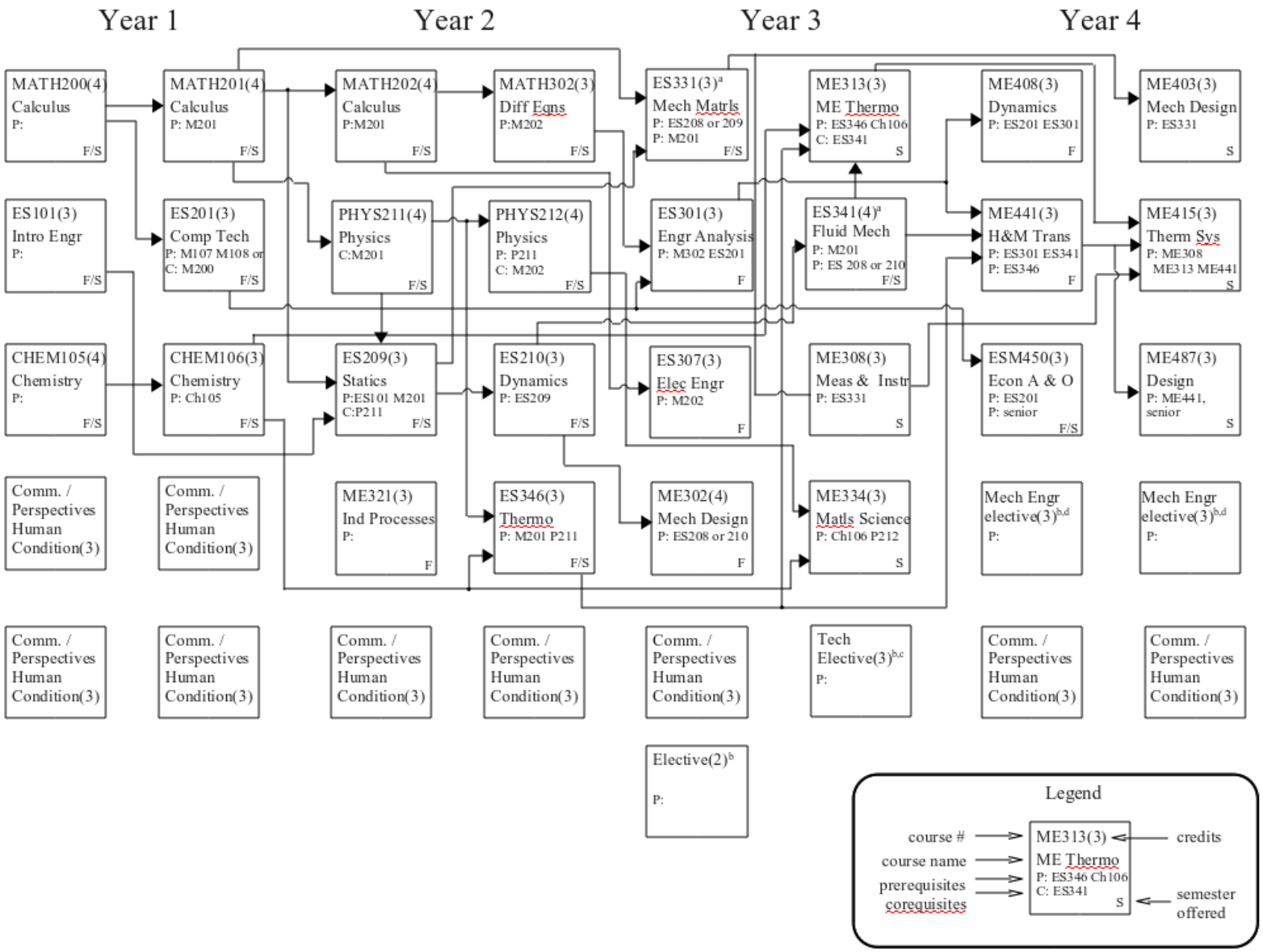
7. Not applicable.

8. Supporting materials available for review during the on-site visit include:

- Additional course syllabi not included in this report.
- Binders of representative student work, including references to specific FCAR assessment tools.
- Capstone senior design progress reports and final reports.
- Examples of all required textbooks.

B. Course Syllabi

See Appendix A for course syllabi.


Year 1
Year 2
Year 3
Year 4
MATH200(4) Calculus P: F/S
MATH201(4) Calculus P: M201 F/S
MATH202(4) Calculus P:M201 F/S
MATH302(3) Diff Eqns P:M202 F/S
ES331(3)[a] Mech Matrls P: ES208 or 209 P: M201 F/S
ME313(3) ME Thermo P: ES346 Ch106 C: ES341 S
ME408(3) Dynamics P: ES201 ES301 F
ME403(3) Mech Design P: ES331 S
ES101(3) Intro Engr P: F/S
ES201(3) Comp Tech P: M107 M108 or C: M200 F/S
PHYS211(4) Physics C:M201 F/S
PHYS212(4) Physics P: P211 C: M202 F/S
ES301(3) Engr Analysis P: M302 ES201 F
ES341(4)[a] Fluid Mech P: M201 P: ES 208 or 210 F/S
ME441(3) H&M Trans P: ES301 ES341 P: ES346 F
ME415(3) Therm Sys P: ME308 ME313 ME441 S
CHEM105(4) Chemistry P: F/S
CHEM106(3) Chemistry P: Ch105 F/S
ES209(3) Statics P:ES101 M201 C:P211 F/S
ES210(3) Dynamics P: ES209 F/S
ES307(3) Elec Engr P: M202 F
ME308(3) Meas & Instr P: ES331 S
ESM450(3) Econ A & O P: ES201 P: senior F/S
ME487(3) Design P: ME441, senior S
Comm. / Perspectives Human Condition(3)
Comm. / Perspectives Human Condition(3)
ME321(3) Ind Processes P: F
ES346(3) Thermo P: M201 P211 F/S
ME302(4) Mech Design P: ES208 or 210 F
ME334(3) Matls Science P: Ch106 P212 S
Mech Engr elective(3)[b,d] P:
Mech Engr elective(3)[b,d] P:
Comm. / Perspectives Human Condition(3)
Comm. / Perspectives Human Condition(3)
Comm. / Perspectives Human Condition(3)
Comm. / Perspectives Human Condition(3)
Comm. / Perspectives Human Condition(3)
Tech Elective(3)[b,c] P:
Comm. / Perspectives Human Condition(3)
Comm. / Perspectives Human Condition(3)
Elective(2)[b] P:
Legend
course #
course name
prerequisites
corequisites
ME313(3)
ME Thermo
P: ES346 Ch106
C: ES341
S
credits
semester offered

CRITERION 6. FACULTY

Faculty responsibilities, evaluation criteria, and workload are governed by three documents in order of increasing standing:

1. Faculty Senate policies (www.uaf.edu/uafgov/faculty-senate),
2. UAF Faculty Appointment and Evaluation Policies and UAF Regulations for the Appointment and Evaluation of Faculty (known as "Policies" and "Regulations," and collectively as the "Blue Book"), found at: www.uaf.edu/provost/promotion-tenure, and
3. United Academics Collective Bargaining Agreement (unitedacademics.net).

A. Faculty Qualifications

Composition

Currently, there are 2 professors, 2 associate professors, and 5 assistant professors in the ME Department, and all 9 of them are full-time faculty. The department has 1 assistant professor, not in a tenure-track slot, who has been teaching an average of about 2 courses a year. All faculty members have earned PhD degrees. Recently, 1 full-rank professor retired from the department, and another has taken a new position as Dean of the college. Their positions have been filled by assistant professors.

Size

Of the 9 full-time faculty members, 8 have 60% teaching workloads on average, and 1 (department head) has a 40% teaching load in lieu of service requirements. This corresponds with about 34 (8 x 4 + 2) potential course slots per year. Each academic year, there are 9 required ME undergraduate courses, 6 required ME graduate courses, 6 undergraduate ME electives, 4 graduate ME electives, and 6 Engineering Science (ES) courses taught by the faculty, for a total of 29. The lower-division ES courses are taught both semesters; they are required for engineers from most of the 5 departments, thus the different departments share the teaching duties. On average, the ME Department teaches 6 of the 14 (7 x 2 semesters). The discrepancy between the standard 29 courses taught and 34 potential teaching slots is often filled with extra elective courses being offered (graduate and undergraduate), sabbatical leave, course release for new faculty members as part of the start-up package, or a faculty member converting part of his or her teaching workload to another area, such as research. In any case, the 9 full-time faculty members are sufficient to teach all required and elective courses in the ME program.

Credentials

The tenured and tenure-track faculty in the ME Department have earned PhD degrees from high-ranking universities (see Table 6-1). Institutions where tenured or tenure-track faculty received their PhDs include CalTech, Drexel, Duke, Iowa State, Nanyang Technical, University of Rhode Island, University of Minnesota, University of Colorado, and University of Wisconsin. The adjunct faculty member's degree is from the University of Alaska Fairbanks

Most ME faculty had industrial or postdoctoral experience before joining the department; their previous experience in government and/or industry ranges from zero to 10 years. Two faculty have engineering registration in Alaska. The research activity levels of the faculty range from medium to high. Professional societies represented include ASME, ASHRAE, IEEE, ASEE, AIChE, AGU, ISTVS, and SAE. Consulting activities are generally low because of the small industrial base in Alaska.

Experience

For the ME Department's 9 faculty, the number of years of teaching experience, either in the department or elsewhere, is as follows: professors, 26 and 26; associate professors, 19 and 7; and assistant professors, 6, 5, 3, 2, 1.

All ME faculty members are significantly involved in research activities; one took a semester of sabbatical leave in 2009 for further research development. The range of research expertise in the department is wide, and faculty members often teach elective courses (undergraduate and graduate) in their areas of expertise. The areas of expertise of our 9 faculty include microfluidics, thermal sciences, mechanical design, energy systems, fluid dynamics, arctic heat/mass transfer, snow and ice mechanics, dynamics and vibrations, and multi-scale materials science. There is little overlapping in faculty specialties, although we would like to have more overlap to build up a critical mass, allow more flexibility in course scheduling, and enhance our research capabilities. Our department and UAF suffers from missed research opportunities because some faculty who could obtain additional research funding have very heavy teaching/service loads, and all faculty have trouble finding staff to teach courses in the process of attempting to buy out courses. There is a slight shortage of faculty to teach required, elective, and engineering science courses that would be optimal for our program, and to provide needed department, college, UAF, and national service even though overall teaching needs can be fulfilled.

B. Faculty Workload

A full-time faculty workload is 30 units for 9 months, as defined in the United Academics Collective Bargaining Agreement (UNAC CBA, unitedacademics.net). A typical tripartite faculty workload would consist of 60% teaching, 30% research, and 10% service (18, 9, and 3 workload units respectively). Teaching credit consists of formal instructional classes, advising undergraduate students, mentoring graduate students, etc. Research activities include all professional activities leading to publication, performance, or formal presentation in the unit member's field, or leading to external funding recognizing the unit member's current or potential contribution to their field. Such activities include manuscript submission, grant proposal submission, supervision of externally funded research projects, development of patentable inventions, additions to a portfolio, and other contributions appropriate to the unit member's field. Service activities include professional service, public service and university service. Typically, a faculty member serves on some committee within the department, college, or university. A 3-credit class is worth 3 workload units. A typical workload consists of four 3-credit courses per year, graduate student supervision, undergraduate student advising, research activities and service activities in all three service categories.

The composition of professional duties and responsibilities of unit members is determined by the appropriate administrator after consultation with the department head/chair and unit member. Faculty members consult the department chair in writing their proposed workload (www.uaf.edu/provost/faculty-reports-forms/faculty-workload-forms), who then submits workloads to the dean, who modifies the proposals if necessary to achieve the overall balance of required work of the college. It is possible to buy out of a course (3 units of workload for 6 weeks of salary) using research funding or internal competitive grants, provided the academic mission of the college can still be effectively delivered. Table 6-2 shows the faculty workload for the Mechanical Engineering Department.

C. Faculty Size

Currently, there are two professors, two associate professors, and five assistant professors in the ME Department. While the number of faculty is just sufficient to cover all required and a few elective courses, there are not enough faculty to offer a wider spectrum of electives, or offer popular electives as often as students request them. Senior exit surveys almost always express a desire that more elective course options were available during the program.

D. Professional Development

The Office of Faculty Development located at 222 Bunnell Building provides professional development opportunities for all faculty members at UAF in the areas of teaching, learning, and scholarship. Assistance with travel, mentoring, promotion and tenure, teaching observations, and instructional technology (through Campus Technology Services) are some of the programs. The office also brings national speakers and trainers to campus, conducts training workshops, and maintains a collection of resource materials on these topics, both in the office and at the Rasmuson Library. Regular workshops, panel discussions, and seminars are held throughout the year for faculty. Although these events are mainly designed for new faculty, they are open to all faculty members, and can be audio-conferenced to the rural campuses if requested. The limited travel funds are generally awarded competitively to new faculty.

Training in other areas such as safety and ethics are also provided through different UAF departments.

CEM provides limited funding on a competitive basis to faculty for professional development activities in academic areas, which include attending short courses that are useful in enhancing the value of courses taught, attending professional conferences and accreditation workshops, and for other areas. INE provides limited funding on a competitive basis for faculty professional development in research areas. Additionally, each year CEM has provided departments with about $10K of travel funding to be used for academic development, including ABET training and development.

E. Authority and Responsibility of Faculty

Program faculty have control over course content, including creation, modification, and evaluation of courses. However, course creations and modifications have to be approved by the department chair, CEM Curriculum Council, CEM Dean, Curriculum Council of the Faculty Senate, and the Provost. Every signatory technically has the same responsibility—ensuring that course proposals minimize content overlap, have resources for effective delivery, have a sound teaching and assessment plan, and are compliant with Faculty Senate guidelines. However, some signatories emphasize certain aspects more than others do. The department chair ensures that the course is consistent with the mission of the program and department, and that resources (faculty, lab, etc.) exist to deliver the course effectively. The CEM Curriculum Council ensures that there is no course duplication within the college and looks at the expected rigor of the course, including contact hours versus credit hours and level of material matching the course number, and that all required content is present and clear on the proposed syllabus, etc. The CEM Dean offers guidance in curriculum development to both the department and Curriculum Council regarding realistic constraints of course enrollment numbers, department faculty capacity, number of courses in the degree program, etc., and must agree with the proposal in order for it to

go forward. The Curriculum Council of the Faculty Senate examines course proposals in the context of the entire university for duplication, and ensures compliance with Faculty Senate and university-wide guidelines on course content, syllabus content, and assessment.

College faculty also examine, modify, and vote on approval of the CEM Unit Criteria, which are the published guidelines used in the evaluation of CEM faculty during the promotion and tenure process (http://www.uaf.edu/files/provost/CEM-unit-criteria-5-1-06.pdf). These Unit Criteria must be approved by CEM faculty at least every 5 years, and change can be initiated by the CEM faculty at any time, but changes are subject to approval by vote of the faculty. The same Unit Criteria are used in pre-tenure (mandatory 4th year evaluations) and post-tenure evaluations of faculty. Unit Criteria are additional to the criteria outlined in the UAF "Blue Book" policies and regulations.

Through regular departmental meetings, department's IAC meetings, and other discussions, faculty members suggest and implement improvements of the program including new programs, emphasis areas, course proposals, the upgrade and acquisition of lab equipment, streamlining course prerequisites, and ABET issues.

Table 6-1. Faculty Qualifications
Mechanical Engineering

Faculty Name	Highest Degree Earned-Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[4]	Years of Experience			Professional Registration/ Certification	Level of Activity H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Cheng-fu Chen	Ph.D. MechEng 2000	ASC	T	FT	3	7	7		M	M	M
Deben Das	Ph.D. MechEng 1983	P	T	FT	7	28	26	AK	H	M	M
Sunwoo Kim	Ph.D. MechEng 2008	AST	TT	FT	3	1	1		M	M	M
Jonah Lee	Ph.D. EngrMech 1983	P	T	FT	3	26	26		H	H	M
Chuen-Sen Lin	Ph.D. MechEng 1988	ASC	T	FT	3	21	19		H	M	M
Jifeng Peng	Ph.D. BioEngr 2009	AST	TT	FT	0	2	2		M	M	M
Rorik Peterson	Ph.D. ChemEngr 1999	ASC	T	FT	0	8	7		M	M	M
Gang Chen (Sheng)	Ph.D. Civil/EnvEng 1997	AST	TT	FT	10	3	3		M	M	M
Jing Zhang	Ph.D. MaterSci 2004	AST	TT	FT	0	5	5		M	M	M

Instructions: Complete table for each member of the faculty in the program. Add additional rows or use additional sheets if necessary. Updated information is to be provided at the time of the visit.

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other
2. Code: TT = Tenure Track T = Tenured NTT = Non Tenure Track
3. The level of activity, high, medium or low, should reflect an average over the year prior to the visit plus the two previous years.
4. At the institution

Table 6-2. Faculty Workload Summary
Mechanical Engineering

Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	Research or Scholarship	Other[4]	
Cheng-fu Chen	FT	ES331(3) F10, ME409(3) F10, ME440(3) S11, ES301(3) S11	60	30	10 (service)	100
Deben Das	FT	ME642(3) F10, ME414(3) F10, M641(3) S11	45	45	10 (service)	100
Sunwoo Kim	FT	ME441(3) F10, ME415(3) S11	30	60	10 (service)	100
Jonah Lee	FT	ME601(3) F10, ES101(3) S11, ME693(3) S11	40	30	30 (service)	100
Chuen-Sen Lin	FT	ME302(4) F10, ME608(3) F10, ME401(3) S11, ME403(3) S11	60	30	10 (service)	100
Jifeng Peng	FT	ME450(3) F10, ME4511(3) S11	30	60	10 (service)	100
Rorik Peterson	FT	ES346(3) F10, ME458/656(3) F10, ME308(3) S11, ME313(3) S11	60	30	10 (service)	100
Gang Chen (Sheng)	FT	ES101(3) F10, ME408(3) F10, ME487(3) S11, ME609(3)	60	30	10 (service)	100
Jing Zhang	FT	ME321(3) F10, ME334(3) S11, ME634(3) S11	45	45	10 (service)	100

1. FT = Full Time Faculty or PT = Part Time Faculty, at the institution
2. For the academic year for which the self-study is being prepared.
3. Program activity distribution should be in percent of effort in the program and should total 100%.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution.

CRITERION 7. FACILITIES

A. Offices, Classrooms, and Laboratories

The university provides basic infrastructure such as classrooms, office space, library facilities, common computer areas, and high-speed Internet connections within campus. The William Elmhirst Duckering Building on campus was completed in 1964, with a large addition constructed in the 1984. In early 2002, after more than a year of extensive renovations, the Duckering Building was rededicated and today it serves as home to the College of Engineering and Mines, including classrooms and lab space. The building is home to all seven engineering programs and four different research units under INE. Given the recent enrollment trends and growing research activities, space has become a big issue. Computer Science is currently housed on the second floor of the Sydney Chapman Building, with space for offices, labs, computational facilities, and classrooms.

Currently, there is no flexibility in mechanical engineering faculty offices, such that there is no place for adjunct faculty to hold office hours, and there is no space for visitors or emeritus faculty members.

About 55 general-purpose classrooms on campus are scheduled by UAF Academic Scheduling in the Registrar's Office. Most engineering classes are taught in the Duckering Building, where there are a total of 9 general-purpose classrooms controlled by Academic Scheduling, with a total classroom area of 6568 ft^2. These nine classrooms are all classified as "smart" classrooms in that they have LCD projectors with laptop/tablet computer connections. Some have additional equipment such as a CD/DVD player, VTR player, dedicated computer, wired Internet connections, a video digitizer, an audio mixer and amplifier, and speakers for any presentation modality. Wi-Fi Internet connectivity is present throughout the Duckering Building. Whiteboards are used in all classrooms. A couple of "Smart Carts"—mobile carts that hold a computer with wireless Internet connectivity and an LCD projector—are also available.

Additionally, many departments have instructional laboratories that are dedicated to specific purposes. A fair number of department courses are taught in these instructional laboratories, and most of them are equipped with "smart" technology. There are several conference rooms in Duckering, and these are equipped with "smart" technology; several have Tandberg videoconferencing capability.

Due to the large enrollment increase in the Mechanical Engineering program, scheduling large enough classrooms is a constant struggle and often results in locations that are not optimal. Similarly, a shortage of space for instructional laboratories, despite lab sharing between different classes, has resulted in schedule conflicts. The machine shop is fully booked in the fall semester with daily lab sections. Most faculty members do not have dedicated research labs.

B. Computing Resources

The program has access to the CEM Engineering Computer Lab (Duckering 530 and 532). These labs used to be known as SOECAL (Students of Engineering Computer Applications Lab). Duckering 530 is configured in a teaching configuration with an instructor computer station, an LCD projector, whiteboard, and 26 student computer stations. Some engineering courses are

scheduled in Duckering 530, including the sophomore-level Computer Techniques course. Other courses use the computing lab for special lectures, such as when a particular software package is demonstrated. When the computing lab is not used for a class, it is open to all engineering students. Duckering 532 is an open computer lab with 18 student computer stations. All stations in both labs are well equipped with engineering software including Matlab, Cadence, Advanced Design System, CAMWorks, SolidWorks, and LabVIEW, as well as standard word processing and graphing software. Both rooms have 24-hour key card access. Security for the lab is provided by the key card-activated door lock and a video surveillance system.

Computational resources in terms of hardware, software, and licenses are adequate. In addition to this lab, students and faculty have access to several campus-wide laboratories and technologies such as:

- Assistive technology lab for disabled students in Whitaker Building Room 206. The lab has numerous specially equipped computers. Lab staff also helps students and faculty create websites accessible to the disabled.
- The Blackboard system that hosts online content for courses that is suitable for both synchronous and asynchronous teaching. Features of the system include ability to post teaching material in a variety of formats, testing, discussion boards, live whiteboard and chatroom, and course management tools.
- Three general computing labs, including the Bunnell Student Access Lab, the MBS Student Access Lab (24-hour, in a student dorm), and the Rasmuson Library Student Access Lab (24-hour).
- An instructional computing lab in the Rasmuson Library.
- Campus-wide wireless access for laptops.
- Arctic Region Supercomputing Center (www.arsc.edu), though it is rarely used for teaching. Program faculty use it more for research, the required government security checks prior to getting an account making it very difficult to utilize in class.

The Mechanical Engineering Department has several more discipline-specific software packages installed in the ME computing lab. These include:

- SolidWorks: This popular software is used by numerous industries and has capabilities for solid modeling, motion analysis, failure analysis, etc. (ME302, 401, 403)
- Virtual Lab: This is a major software program used by industries in the dynamic field (e.g., automobile, aircraft, etc.); capabilities include geometrical modeling, dynamic analysis, and stress analysis of complex 3D dynamic systems. (ME602/402)
- CAMWorks: A major software program used in computer-aided process planning to convert solid model data into computer numerical control codes for manufacturing tool control. (ME401)

C. Guidance

Guidance for students is provided as needed for each particular class. The faculty instructor is in charge of determining the level of instruction and guidance necessary before students are prepared to use both mechanical equipment and computing resources. In some instances, teaching assistants are able to help provide training and demonstration, in particular with software applications, which are overseen by the faculty member.

D. Maintenance and Upgrading of Facilities
The faculty instructor in charge of each lab course is responsible for assuring that equipment and facilities are maintained in safe and working order. They are also responsible for determining when lab equipment needs replacement and/or upgrading. There are limited resources earmarked for regularly replacing and upgrading equipment, and specific requests are made and prioritized each fiscal year.

E. Library Services
The Rasmuson Library website, www.uaf.edu/library, provides detailed information about departments, services, and collections within the Rasmuson Library, and provides access to information through its online catalog (Goldmine). The entire system catalog can be searched by author, title, subject, or other search method using library.uaf.edu/goldmine. This site can be accessed by students, faculty, and the public. Current journal subscriptions and e-journals licensed for UAF use are available through the Journal List web page, also accessed through the Library website.

Goldmine can be used to locate not only what is owned by the Rasmuson Library, but also what is owned by all the sites in the University of Alaska statewide system. For example, the Interlibrary Loan page provides information on how to obtain books, photocopies, or audiovisual materials that are not available on campus from other library locations, how long it takes, renewals, general policies, Web Document Delivery, how to access an online request form, and more. In addition, a wide variety of subject-specific databases is available in the library via the Elmernet local area network (only searchable in the library), and via the Internet to UAF students, faculty, and staff. On-campus users may access all resources listed on the library website from any campus public, office, or dorm room computer. Off-campus use of licensed e-resources (with the exception of the "Databases for Alaskans" collection) is restricted to UAF faculty, students, and staff, and requires that UAF users log in using their UAF computer ID and password.

The library currently subscribes to more than 130 electronic databases including online indexes, full-text journal article collections, e-books, and encyclopedias. Some of the database searches available to UAF students, faculty, and staff are listed in the table that follows this section. Additional resources are frequently added to the library website, including article indexes and collections, alphabetical or subject lists for the most current listings, as well as access to information resources available online.

As part of UAF's core curriculum, undergraduate students must demonstrate their library proficiency either by completing LS101 (Library Information and Research) or by passing a competency exam. In LS101, students learn about library research using the Internet, and about finding information in a variety of subject areas.

Additionally, librarians and library staff are available to assist students in using library resources and can give guidance on how to best locate research and information resources both in the library and beyond, regardless of format. Assistance can be provided by phone, email, and live chat with a librarian or library staff member.

The Rasmuson Library is the largest in the state, with more than 1.1 million volumes. Special collections include the world-class Alaska and Polar Regions collections, covering books, periodicals, archives, manuscripts, historical photographs, oral histories, and maps. A branch of the Rasmuson Library, the Biosciences Library on West Ridge, contains a substantial collection of books and journals. The Geophysical Institute operates the Mather Library to support student, staff, and faculty research needs in the geophysical area. Services provided by the Rasmuson Library include:

- Carrels – Available for grad students on a first-come/first-served basis.
- Circulation – Information about borrowing books and videos, overdue policies, and your library account.
- Conference and Meeting Rooms – Reserve rooms within the library.
- Digital Photographic Services – Professional digital imaging services available to the university community and to the public. Offers digital printing and high-resolution scanning.
- Document Delivery – Request book chapters and paper journal articles be scanned and emailed to you as a .pdf file.
- Interlibrary Loan – Borrow material from other libraries.
- Instruction – Whether student, faculty, or staff: How to use library resources.
- Media Services – Borrow media equipment such as digital cameras, camcorders, laptops, and more. Popular and reference DVDs and CDs are available for check out.
- Off-Campus Services – A unit set up to serve rural UAF students and faculty who do not have access to appropriate information resources in their town or village.
- Reference Services – Help with research.
- Reserves – Reading materials for specified classes.
- Room Scheduling – Reserve rooms for study sessions, group meetings, conferences, and teaching.

The Rasmuson Collection Development Officer periodically polls all faculty on campus on program needs for books and/or subscriptions. Here is her most recent email specifically to CEM:

> *Dear College of Engineering faculty and graduate students:*
>
> *With Spring Semester almost over, I know most of you won't be thinking about library collections, but since we remain open and work through the summer months, it's a perfect time for us to acquire whatever books you might need for Fall Semester. We do have funds available for book purchases, and we are right now prioritizing our journal subscription requests as well, so if you have suggestions, please send them to me before you leave campus, if possible. I also welcome any assistance from faculty in weeding the older material out of our collections; we rely on your subject expertise to help us make these decisions.*
>
> *I also wanted to fill you in on one of our latest acquisitions: the Earth and Environmental Sciences set of ebooks from Springer. These will be added to our Goldmine catalog shortly so that you can link directly, and will be hosted on the Springer platform which allows downloading to almost any device, as well as printing and simultaneous user access. This set has more than 1000 books, including multiple disciplines. If you want to*

glance through the title list here is the URL, choose Earth and Environmental:

http://www.springer.com/librarians/e-content/ebooks?SGWID=0-40791-12-377411-0

This book deal is good for all UA campuses; we hope to do more of these types of UA-statewide purchases in the future, so that faculty and students at all campuses can benefit.

Finally, it has been a banner year for use of the EBL or electronic books system. Use has more than tripled since we began this project several years ago. If you haven't tried EBL books yet, or you'd like me to demonstrate it for a group or individually, I'm happy to do so.

Please let me know if you have any questions, and feel free to stop by any time to share suggestions or concerns. Have a great summer!

Karen Jensen
Collection Development Officer
Rasmuson Library
University of Alaska Fairbanks

The electronic UAF library catalog is called Goldmine (library.uaf.edu/goldmine), and is an easy-to-use resource for searches. Electronic Books Online (EBL) provides both short-term loans and auto-purchasing options for ebooks, on all topics. Readers may view material online, download to a computer for a limited time, and copy or print a small amount of material from these ebooks. A login is required from both on- and off-campus. The library director noted the incredibly fast transition to electronic materials from traditional print materials: *"We circulated 34,572 physical books in 2010 while EBL in its first full year of use circulated 33,411 book titles. When combined with the library's other [electronic] book collections – Safari, Psycbooks, Netlibrary, Springer, Elsevier, etc. – we expect to see that the use of digital titles now substantially surpasses the circulation of more typical library materials."*

Available databases include:

Applied Science and Technology Abstracts FirstSearch Database	Engineering, mathematics, physics and computer technology.
ABI/INFORM Global ABI/INFORM Global Database	Indexing for articles in over 1,200 international business, management, and marketing journals, including many computer science representative trade journals. Beginning in 1970 with some full-text. Current search of "Computer Science" as subject yields 2,506 documents.
ACM Digital Library Core Package ACM Digital Library	Full text collection of every article published by ACM, including over 50 years of archives.
Computer Source EBSCOhost Database	Includes full-text and citations for current trends in high technology, covering topics such as computer science, programming, artificial intelligence, cybernetics, information systems, robotics, and software. Dates back to 1985.

Compendex® Engineering Village 2	Most comprehensive interdisciplinary engineering database in the world. Compendex contains over 8 million records and references over 5,000 international engineering sources including journal, conference, and trade publications. Coverage is from 1969 to present and the database is updated weekly.
IEEE All Societies Package IEEE Xplore	Includes access to abstracts and full-text of IEEE journals, transactions, and magazines published since 1998.
IEEE Core Proceedings IEEE Core Proceedings	Contains core collection of IEEE conferences from 1998 to present.
INSPEC ISI Web of Knowledge	Provides bibliographic information and some full-text from the world's leading scientific and technical literature, covering subjects such as physics, engineering, electronics, computers, and information technology. From 1969 to the present.
Institute of Physics (IOP) Online Journals IOP Journals Online	Access to a variety of full text journals in the area of physics, math, and engineering.
Kluwer Online springeronline.com	Full text journals, primarily in the sciences and social sciences, published by Kluwer Academic Publishers. Currently includes 96 Computer Science journals.
MathSciNet MathSciNet Database	Mathematical reviews on the Web. MathSciNet is a comprehensive database covering the world's mathematical literature since 1940.
NTIS CSA Internet Database Service	Produced by the National Technical Information Service, the NTIS database is the preeminent resource for accessing the latest U.S. government-sponsored research and worldwide scientific, technical, engineering, and business-related information.
Safari Tech Books Online safaribooksonline.com	An online library that provides full-text access to a current collection of 2,622 information technology books.
Science Citation Index Expanded and Web of Science Rasmuson Library-Article Indexes and Collections	Provides access to current and retrospective bibliographic information, author abstracts, and cited references found in the world's leading scholarly science and technical journals.
Science Direct Web Editions Sciencedirect.com	A current awareness service from Elsevier Publishing that provides full-text access to the current year journals in science, technology, and medicine that match UAF's print subscriptions.
Wiley Interscience Enhanced Access Wiley Interscience Home	Access to full text journals. Multidisciplinary coverage.

Overall, the library capabilities are quite adequate for the program.

F. Overall Comments on Facilities

Faculty and staff monitor the safety of facilities, tools, and equipment used to deliver the program. Additionally, the UAF Office of Environmental Health Safety and Risk Management and the Provost's Office have safety standards that must be followed for all university facilities and processes. One of the CEM technicians, Paul Brown, is the college safety officer; he examines CEM labs, facilities, and processes to ensure safety compliance. Egress placards are placed throughout the Duckering Building. In addition, faculty members receive safety trainings when needed, say, for particular labs. Walk-throughs in the lab areas by the department chair, in conjunction with involved faculty members, are conducted from time to time to spot-check potential safety issues.

CRITERION 8. INSTITUTIONAL SUPPORT

A. Leadership

The department chair is an elected 2-year position. Faculty Senate policy (www.uaf.edu/uafgov/faculty-senate/policies-procedures/department-chair-policy) defines the role of the department chair as follows:

1. The department chair is the administrative and academic officer of the department and as such has the primary responsibility and authority for: (1) leadership in developing high quality academic programs which fulfill department, college, and university objectives; (2) leadership in the implementation of college and university policies and programs at the department level; (3) leadership in developing resource requests and an appropriate departmental budget; and (4) service on the college/school executive committee.
2. The department chair is first a faculty member. The department chair is primarily a teacher-scholar serving as a leader of his/her department colleagues. The department chair is a role model for faculty responsibility.
3. The department chair is responsible for providing mechanisms and processes for members' participation in discussion and decision making within the department. All members of the department should be informed of these mechanisms and processes. Regular meetings should be held for purposes of communicating information, discussing issues, and making decisions on department matters.
4. The department chair is expected to communicate faculty perspectives and concerns to the administration and other segments of the community as appropriate. The department chair is the primary spokesperson the faculty of the department. The department chair will also convey administration views and concerns to the faculty.

The department chair is responsible, either directly or by delegation, for performance of at least the specific duties enumerated below (the duties are not prioritized) which shall be performed in accordance with the extant collective bargaining agreements on the role and status of department chairs.

A. Academic Programs

1. Initiate, plan, oversee implementation of, and review the preparation and offering of the academic program, after appropriate involvement of members of the department and consultation with the dean.
2. Ensure interdepartmental coordination and cooperation.
3. Take leading role in ensuring academic program quality.
4. Ensure reports are prepared as needed. Ensure that course schedule is prepared in a timely manner.
5. Ensure catalog is current.
6. Supervise departmental office and ensure that files and records are maintained.
7. Keep the dean informed of departmental and faculty activities. Act as a liaison with the University community.

B. Personnel

1. Coordinate and evaluate professional activities of all members of the department, to include providing guidance to faculty concerning expectations regarding promotion and tenure. Request and obtain faculty activity reports as appropriate to this process.

2. Provide recommendations for appointments, promotion, sabbatical leaves, tenure, and release of faculty after consultation with members of the department.
3. Review and recommend to dean/director workloads as proposed by faculty members.
4. Take lead role in departmental faculty and staff recruitment and retention.
5. Provide for the management and supervision of support staff.
6. Appoint appropriate committees within the department.
7. Facilitate support for faculty teaching, research and service activities.
8. Function as spokesperson and advocate for the department, both within and outside the University community.

C. Students

1. Administer the departmental student advisement program and counsel students.
2. Recruit students in cooperation with other members of the department and the dean.
3. Act on student petitions.
4. Provide for the management of student assistants.
5. Address student concerns as appropriate.

D. Budget, Inventory, Facilities, etc.

1. Initiate resource and budget requests with justifications.
2. Maintain fiscal control of departmental budgets.
3. Ensure upkeep of equipment and facilities assigned to the department

B. Program Budget and Financial Support

The dean determines the budget for the departments, given the funding allocated to the college. Starting with historical data, continuation budgets are developed for each department by adding budget increments, if applicable, to the budget levels from the previous fiscal year. Travel and equipment categories are not initially funded. Central funding for travel is distributed later to departments and awarded competitively to faculty from the CEM and INE travel programs. The equipment budget is funded centrally through a number of sources. These funds are distributed to departments toward the end of the fiscal year. Any equipment costing less than $5K is classified as a commodity. Student fees in computer labs and other labs are directed to the appropriate department and reinvested in the laboratories. Table 8.B-1 details program expenditures over the past five years.

Table 8.B-1. Program Academic Year Expenditures

Budget Category	AY06-07	AY07-08	AY08-09	AY09-10	AY10-11	Total
Commodities	17,902	95,121	18,966	41,087	35,585	208,661
Contractual Services	21,344	9,643	11,108	20,731	10,844	73,671
Equipment	78,119	31,084	0	0	6,970	116,173
Salaries & Benefits	903,228	963,159	1,113,535	1,018,779	1,159,375	5,158,075
Travel	14,081	21,225	9,521	23,489	11,163	79,478

AY10-11 figures are to-date through of 6/13/2011

1. A continuation budget for the department for the coming fiscal year is provided, but often in an ad hoc and untimely manner, such that proper planning is at times difficult. Except for faculty and permanent staff salaries, which are permanent, other budget items are oftentimes fluid and ad hoc.

2. The Mechanical Engineering Department no longer has a teaching assistant budget, as it was recently centralized. With increases in enrollment, the number of TAs from the centralized fund has remained the same. Any additional TAs or graders are usually hired from the department's salary savings.

3. The most common funding sources used by the department for acquisition, maintenance, and upgrading of facilities and equipment include (a) successful competition of proposals submitted by faculty members and members of student societies to the Technology Advisory Board (TAB) funded by student technology fees and awarded by the Chancellor; (b) successful proposals to RFPs from the Provost's Office; (c) department salary savings; (d) department budget mostly from student lab fees; (e) college end-of-the-year surplus fund allocation; and (f) research grants for equipment that can be used for both research and instruction purposes.

4. Shortages in lab and class spaces, TAs, and technicians, and lack of a robust budgeting process are areas that need improvement in order to enhance the program.

C. Staffing

The department has a full-time office manager and sometimes a part-time student assistant, which is adequate for the program. The department has a full-time research professional in charge of the instructional machine shop, as well as a temporary part-time technician for the machine shop. Due to the increase in enrollment, the temporary part-time technician should be made permanent. In addition, the department does not have a lab technician, which makes the upkeep of the lab facilities difficult.

In addition to department staffing, CEM has the following positions that are shared by all the engineering programs for a variety of direct and indirect instructional support:

- Two network technicians
- One technician and building safety officer
- One mechanical technician
- One academic advisor
- One recruiting coordinator
- One chief fiscal officer
- One academic manager

The Institute of Northern Engineering is part of CEM and has several dedicated technicians and administrative personnel that are available to help on an "as needed" basis.

D. Faculty Hiring and Retention

The process of hiring a new faculty starts with a memo from the department chair requesting permission from the Provost (through the Dean) to hire. Once permission is received, a

committee is set up by the program faculty in consultation with the department chair and Dean. The committee develops the job description and follows university guidelines in the hiring process. Faculty searches, an integral part of the hiring process, are typically international.

As soon as the formalities are completed, the job is posted on UAKJobs, and formal ads are posted as classified ads locally and in magazines sponsored by professional organizations such as ASME and ASEE. After achieving a certain pool of applicants or after a specified date (determined by the search committee) the candidates go through multiple screening stages such as a review of the resume and qualifications, a telephone interview, and on-campus visits and reference checks. Near the end of the process, the committee makes a recommendation to the Dean in the form of a ranked list. Once the Dean's selection is made and approved by the Provost, an offer is made. Offered salaries typically conform to the Oklahoma State University salary survey.

Retention strategies for new faculty include targeted start-up funds to enable the new faculty to develop a successful research program early in their UAF career. Additionally, lower teaching loads are offered in the first two years, along with reduced service workload. All new faculty are assigned, or may choose, a faculty mentor, typically in their department, to help assist with the transition to a demanding academic career. Faculty development opportunities, through CEM and INE travel grants and through the UAF Office of Faculty Development, are intended to help with retention. If a current faculty member has a formal or informal job offer from another employer, the Dean has the option of increasing the salary for the faculty member in the form of a "retention raise."

E. Support of Faculty Professional Development

Sabbaticals are governed by the Collective Bargaining Agreement between UAF and the faculty union. Tenured or tenure track unit members who have completed at least 5 consecutive years of service within the unit are eligible for consideration to take sabbatical leave during the 6th or subsequent year of service. However, faculty consult with the department chair prior to applying for sabbatical leave in order to help the department and the program plan for the absence. An application for sabbatical leave is ranked by the department chair, the CEM Peer Review Committee, the CEM Dean and awarded by the UAF Provost. Sabbatical leaves are granted for periods of one academic year at the rate of six months' salary or one semester at the rate of one semester's salary.

Professional development of faculty has been discussed in Criterion 6-D. As mentioned, faculty sponsor their professional development activities through a combination of competitively awarded CEM academic travel grants, external research grants, and sometimes through non-university sponsors. The college provides additional travel funding to the departments, and faculty course buyouts have allowed the department to fund travel internally. Faculty have been able to undertake professional development activities, and have remained current, however there is no guaranteed funding to the college for this purpose.

PROGRAM CRITERIA

Program criteria for the Mechanical Engineering curriculum require the ability to work professionally in both thermal and mechanical areas. Our program has three senior (400-level) courses with significant design components that are part of the required curriculum. ME 415 – Thermal Systems Laboratory is completely devoted to addressing the thermal component, while ME 403 – Machine Design is devoted to the mechanical component. Finally, ME 487, the senior capstone Design Project, once again addresses one or both of these areas. All senior design projects must first be approved by the course instructor, who assures that significant design work will be performed in at least one of these areas.

The criteria also require that graduates model, analyze, design, and realize physical systems, components, and processes. While these areas are often clearly addressed in the courses discussed above, the skills and techniques are also introduced earlier in several junior-level courses. ME 441 – Heat and Mass Transfer uses both problem-based and design assignments for modeling and analyzing systems such as heat exchangers. ME 313 – Mechanical Engineering Thermodynamics uses both analytic and numerical/computer-based techniques for modeling and analyzing power cycles (Rankine, Brayton, Diesel, etc.) and refrigeration (single and multi-stage). ME 302 – Dynamics of Machinery also uses both analytic and numerical/computer-based techniques to design mechanical components.

APPENDICES

Appendix A – Course Syllabi

Course syllabi for required and elective courses that compose Mechanical Engineering program are included in three subsections. Mechanical Engineering courses are in A-1, Engineering Science courses that are common to several engineering disciplines are in A-2, and syllabi for math and science courses offered outside the engineering department are in A-3. A list of the courses in these three sections is shown below. Elective courses in Mechanical Engineering are in italics.

Mechanical Engineering (ME)	**Engineering Science (ES)**	**Science and Mathematics**
ME 302 Dynamics of Machinery	ES 101 Introduction to Engineering	CHEM 105 General Chemistry I
ME 308 Measurement and Instrumentation	ES 201 Computer Techniques	CHEM 106 General Chemistry II
ME 313 Mechanical Engineering Thermodynamics	ES 209 Statics	PHYS 211 General Physics I
ME 321 Industrial Processes	ES 210 Dynamics	PHYS 212 General Physics II
ME 334 Elements of Material Science/Engineering	ES 301 Engineering Analysis	MATH 200 Calculus I
M E 401 Computer Aided Design and Manufacturing	ES 307 Elements of Electrical Engineering	MATH 201 Calculus II
M*E 402 Advanced Mechanical System Design*	ES 331 Mechanics of Materials	MATH 202 Calculus III
ME 403 Machine Design	ES 341 Fluid Mechanics	MATH 302 Differential Equations
ME 408 Mechanical Vibrations	ES 346 Basic Thermodynamics	
ME 409 Controls		
ME 414 Thermal Systems Design		
ME 415 Thermal Systems Laboratory		
ME 416 Design of Equipment for the Petroleum Industry		
ME 440 Introduction to Microfluidics		
ME 441 Heat and Mass Transfer		
ME 450 Theory of Flight		
ME 451 Aerodynamics		
ME 452 Introduction to Astrodynamics		
ME 453 Propulsion Systems		
ME 458 Energy and the Environment		
ME 464 Corrosion Engineering		
ME 487 Design Project		

Appendix A-1 – ME Courses

1. ME 302 Dynamics of Machinery

2. Credits and Contact Hours: 4 credits (3+3)

3. Instructor: Dr. Chuen-Sen Lin

4. Text Book, Title, Author, and Year:
   - "Kinematics, Dynamics, and Design of Machinery," by Waldron and Kinzel, Wiley, October 2003.
   - Handouts for specific topics: Equivalent linkages, quality function deployment method, plate cam analytical solution.
   - LINKAGES software.
   - SolidWork/Motion software and manual.

5. Specific Course Information:
Required Course.
Catalog Description:
Kinematics and dynamics of mechanisms. Analysis and design of displacements, velocities, accelerations, and forces in linkages, cams and gear systems by analytical, experimental, and computer methods.
Prerequisites: ES210.
Co-Requisite: ES301.
Instruction Method: Lecture (3 hours per week) and lab (3 hours per week)
Grading Policy:
Quizzes and homework (10%)
Design project (Report: 15%. Presentation: 5%) - A project will be assigned (or proposed by students). Students are encouraged to work together as groups. Each group is expected to submit an intermediate project report (seventh week) and a final report (last week), exhibit design model and/or simulation model, and give oral presentation.
Laboratory reports (15%) - 5 labs. Students need to turn in lab reports at designated times
Tests and final exam (Two tests: 30%, Final: 25%).

6. Specific Goals for the Course:
Course Objectives:
To learn-
Mechanisms (linkages, cams, gears, etc.) design process.
Prediction of types of accelerations of mechanisms.
Applications of synthesis and analysis (kinematic and dynamic principles) in mechanisms design.
Design presentation.
To practice-
Mechanisms design process using design projects and computer software application.
Communication skills via oral presentation and design report writing.
General knowledge via labs, homework assignments, quizzes, and tests.
Goals Related to ABET Specific Outcomes:

(a) An ability to apply knowledge of mathematics, science, and engineering.
(c) An ability to design and conduct experiments, as well as to analyze and interpret data.
(e) An ability to identify, formulate, and solve engineering problems.
(j) Knowledge of contemporary issues.
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

7. Brief List of Topics to be covered:
Introduction to system degrees of freedom (2D and 3D), types of mechanisms, mechanism work space, design parameter selection, current linkage applications, etc.
Graphical method and general vector formulation in kinematic analysis.
General rolling and sliding motion, cam design, and gear train design.
Instant center and equivalent linkage methods.
Linkage synthesis.
Mechanisms static analysis and dynamic analysis.

1. ME 401 Syllabus
Computer Aided Design and Computer Aided Manufacturing (CAD/CAM)

2. Credits and Contact Hours: 3 credits (1+4)

3. Instructor: Dr. Chuen-Sen Lin

4. Text Book, Title, Author, and Year:

- No designated textbook.
- Software and manuals (SolidWorks, SolidWork/Simulation, SolidWork/Motion, and CamWorks)
- Hardware and manuals (MaxNT, MaxT2, HAAS Lath and Vertical Center, and ThermlJet 3D Printer).
- Other related handouts.

5. Specific Course Information:
Elective Course
Catalog Description:
Introduction to the principles of computer aided design (CAD) and computer aided manufacturing (CAM). Entry-level applications of software and hardware in solid modeling, finite element modeling (FEM), rapid prototyping, and computer numerical control (CNC). Design project.
Prerequisites: ME321, ES331, and ES210
Instruction Method: Lecture (one hour per week) & lab (four hours per week)
Grading Policy:
Letters with plus and minus
Tests (20%) -
Two tests.
Projects (60%) -
Five Poojects. Project report may be turned in within 1 week after the due date with a 15% deduction. Project report submitted more than 1 week after the due date will receive 0 points.
Homework (20%)-
Homework will be collected at designated times. Homework may be turned in within 2 days after the due date with a 30% deduction. Homework submitted more than two days after the due date will receive 0 points.

6. Specific Goals for the Course:
Course Objectives:
To learn-
CAD process and design intent
Design analysis
Rapid prototyping process
CNC programming
Automatic process planning procedure
To practice-
CAD using SolidWorks

Design analysis using SolidWorks-Simulation
Prototyping Procedure using ThermoJet 3D Printer
CNC programming and CNC process using MaxNT (a desktop lathe), MaxT2 (a desktop milling machine), and a HAAS lathe and a HASS vertical center
Automatic process planning procedure through CamWorks demonstration
Goals Related to ABET Specific Outcomes:
(a) An ability to apply knowledge of mathematics, science, and engineering.
(c) An ability to design a system, component, or process to meet desired needs within realistic constraints.
(e) An ability to identify, formulate, and solve engineering problems.
(i) A Recognition of the need for, and an ability to engage in life-long learning.
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

7. Brief List of Topics to be covered:
Solid modeling for part, assembly, and engineering drawing
Advanced solid modeling methods, such as revolve, swept, loft, import/export, pattern, top-down assembly, etc.
Design analysis process for parts and assemblies using FEM (i.e., restraints, connections, loading, meshing, computation, post processing, etc.)
Automatic process planning demonstration (i.e. Solid model, stock selection, feature recognition, path planning, etc.)
CNC programming
Rapid prototyping file preparation

1. ME 402/602 Syllabus
Advanced Mechanical Systems Design

2. Credits and Contact Hours: 3 credits (3+0)

3. Instructor: Dr. Chuen-Sen Lin

4. Text Book, Title, Author, and Year:
"Dynamics of Multibody Systems," 2005, Ahmed A. Shabana, Cambridge.

5. Specific Course Information:
Elective Course
Catalog Description:
Advanced analysis of two- and three-dimensional multi-body mechanical systems. Rigid body system formulation and deformable body system formulation. Application of CAE software for rigid body and large deformable body systems. Special fees apply.
Prerequisites: ME F302; ME F408; or permission of instructor.
Instruction Method: Lecture (three hours per week)
Grading Policy:
Letters with plus and minus
Final Exam (30%)-
Test for undergraduate students will not involve deformable multi-bodies problems.
Project (Written report: 30%. Oral presentation: 10%)-
A design and/or simulation project related to multibody dynamic systems.
Graduate students are required to work on deformable multi-body system projects.
Undergraduate students are required to work on rigid multi-body system projects.
Project involves application of Virtual Lab software.
Homework (30%)-
Undergraduate students are not required to do homework problems which involve deformable bodies.
Deformable multibody dynamics, which involves rigid body dynamics and continuum mechanics and/or FEM, is beyond the scope of an undergraduate course.
Homework will be collected at designated times. Homework may be turned in within 2 days after the due date with a 30% deduction. Homework submitted more than two days after the due date will receive 0 points.

6. Specific Goals for the Course:
Course Objectives:
To learn:-
General methodology of dynamic analysis for both rigid and deformable multi-body systems.
Implementation of multi-body dynamics solution methods using digital computers.
To practice-
General methodology via homework, exam, and design project.
Computer implementation via computer software homework and design project.
Goals Related to ABET Specific Outcomes:
(a) an ability to apply knowledge of mathematics, science, and engineering,

(c) an ability to identify, formulate, and solve engineering problems
(g) an ability to communicate effectively.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practices.

7. Brief List of Topics to be covered:
Introduction to multibody system description requirement and Virtual.Lab.
Reference kinematics.
Analytical techniques involving rigid multibody systems.
Virtual.Lab applications for rigid multibody systems.
Mechanics of deformable body.
Analysis techniques for multibody systems with deformable compontnts.
Virtual Lab applications involving deformable multibody system.

1. ME 403 Machine Design

2. Credits and Contact Hours: 3 credits (3+0)

3. Instructor: Dr. Chuen-Sen Lin

4. Text Book, Title, Author, and Year:

- "Fundamentals of Machine Component Design," 2006, Juvinall & Marshek, Wiley.
- Handout for specific topics: Shaft design.
- SolidWork/Simulation software and manual.

5. Specific Course Information:
Required Course.
Catalog Description:
Analysis and design of machine components using failure theories. Strength, life, and reliability analysis. Study of design principles and selection procedures for standard machine components. Design projects.
Prerequisites: ES331
Instruction Method: Lecture (3 hours per week)
Grading Policy:
Homework (15%)
Design Project and quizzes (15%)- project will be assigned. Students are required to work individually and submit individual.
Two tests (40%)
Final (30%)

6. Specific Goals for the Course:
Course Objectives:
To learn-
Failure Theory (Static, impact, fracture, fatigue, surface, etc.) and machine component design.
Design analysis procedure using SolidWorks/Simulation
To practice:
SolidWorks/Simulation design analysis procedure via a computer homework assignment and design project.
Failure theory and component selections via homework, tests, design project.
Goals Related to ABET Specific Outcomes:
(a) An ability to apply knowledge of mathematics, science, and engineering.
(c) An ability to design and conduct experiments, as well as to analyze and interpret data.
(e) An ability to identify, formulate, and solve engineering problems.
(j) Knowledge of contemporary issues.
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

7. Brief List of Topics to be covered:

Introduction to some new applications, efficiencies of different components, statistics of different types of failures.
Safety factor and reliability applications.
Failure theories in static loading and fatigue loading.
Residual stress applications.
Failure by fracture, impact, wear, corrosion, and surface contact.
Theories of different types of machine components and their selection processes (e.g., bearings, screws, gears, shaft).

1. ME 408 Mechanical Vibrations
2. Credits and contact hours

Course credits: 3; Lecture: MWF 1145-1245; Office Hr: MWF 2-4P (or by appointment)

3. Instructor's or course coordinator's name

Gang Sheng (Gang Chen)

4. Text book, title, author, and year

   Mechanical Vibrations, 4th Ed, S. Rao, Prentice Hall, 2003.

5. Specific course information

   This class will study the response of mechanical systems to excitations. Topics include free and forced vibration of discrete systems.

   Students must have taken ES 201, 210, 301.

6. Specific goals for the course

   This class will allow student to have a good understanding of the modeling of vibratory motion of mechanical systems, including both single and multiple degree of freedom systems; study free and forced response of these systems; be able to design simple vibration isolation/absorber systems; understand the modal summation method for response predictions; master basic simulation techniques of the vibration system by using Matlab.

7. Brief list of topics to be covered

Course contents

Date	Topic/Activity	Textbook	Homework	Notes #	#
	Introduction of Mechanical Vibrations	1.1~1.4		1	1
	Vibration systems and modeling	1.5~1.9			2
	Harmonic motion and analysis	1.10			3
	Math / Dynamics review with Matlab		HW 1		4
	Math / Dynamics review with Matlab				5
	1DOF system concepts	2.2~2.3		2	6
	1DOF systems, Free vibration without damping		HW 2		7
	Energy Method				8
	Quiz 1 11:45~12:45				9
	Free vibration with viscous damping, log decrement	2.6	HW 3	3	10
	Coulomb damping and structural damping	2.7~2.8			11
	Forced vibration without damping	3.3		4	12
	Forced vibration with damping--Harmonic force	3.4~3.5	HW 4		13
	Forced vibration-Base excitation.	3.6		5	14
	Forced vibration-Rotating unbalance	3.7			15
	Forced vibration-Periodic force excitation	4.1	HW 5	6	16
	Forced vibration- Periodic Forces, Fourier series	4.2			17
	Exam 1 11:45~12:45				18
	Response under a periodic function	4.2~4.3	HW 6		19
	Response to an arbitrary forcing function	4.4		7	20
	Impulse motion & convolution integral	4.5			21

	Response to an arbitrary forcing function	4.6	HW 7		22
	2DOF Systems and Modeling	5.1~5.2		8	23
	Matrix equations, eigenvalue problem				24
	Free undamped systems	5.3		9	25
	Free undamped systems	5.5			26
	Forced undamped vibration	5.6			27
	Forced undamped vibration: Vibration absorbers	5.6	HW 8		28
	2DOF Vibrations---Review & Examples	5.6		10	29
	2DOF Vibrations---Review & Examples	9.11		11	30
	Exam 2 11:45~12:45				31
	Introduction to Multiple DOF Systems & Modeling	9.11			32
	Multiple DOF Systems & Modeling	6.1~6.3		12	33
	Generalized coordinates and Lagrange's Equation	6.4	HW 9		34
	Normal modes vibrations, orthogonality of normal, mode vector	6.6~6.7			35
	Free undamped vibration	6.8~6.10		13	36
	Free undamped vibration		HW 10		37
	Quiz 2 11:45~12:45	6.11			38
	Forced undamped vibration				39
	Forced damped vibration	6.13	HW 11	14	40
	Final review	6.14			41
	Final review	6.15		15	42
	Final Exam 10:15~12:15				43

Exams. Two quizzes, two mid-term exams and one final exam will be held (see Schedule in p.2 for more details). No make-up exams will be held. Notify the instructor in case of emergency at the earliest possible opportunity.

Homework. Weekly homework will be assigned will be due in the following week.

Grading Policy:

Homeworks 30%

Quizzes (2) 20%

Exams (2) 30%

Final Exam 20%

Plus/Minus grading will be used – see page 47 of the 2010-2011 UAF catalog for numerical values.

1. **ME 409 –Controls**

2. 3 credits, Lecture: MWF 2:15 – 3:15pm, no lab hour.

3. Instructor: Cheng-fu Chen (ME)

4. K. Ogata, *Modern Control Engineering*, 5th Ed., Prentice Hall, 2010.
    a. Lecture slides are posted on Blackboard. 5+ numerical functions implemented by the instructor are also uploaded online for students learning.

5. Specific course information
    a. Catalog description: Analysis and design of control systems Block diagrams, transfer functions, and frequency analysis Closed loop systems and system stability. Industrial controllers and system compensation
    b. Prerequisite: ES 201 and ES 301.
    c. Elective course

6. Specific goals for the course
    a. To develop knowledge to employ classic and linear control theories for analysis of linear, time-invarient dynamic systems.
    b. To develop knowledge to measure and evaluate dynamic system performance.
    c. To develop knowledge of designing linear controllers and performing feedback compensation to influence the dynamic performance.
    d. To develop knowledge of the use and utility of computer tools for control analysis and design.

7. Brief list of topics to be covered

    Introduction - modeling of physical systems.
    Introduction of Laplace Transforms and transfer functions.
    Introduction of block diagrams.
    State variable representation.
    Stability analysis
    Time domain system response.
    Root locus technique.
    Frequency domain system response.
    Design and compensation.

1.ME 414 - THERMAL SYSTEMS DESIGN

2. **Three credits**, three contact hours per week

3. **Instructor:** Dr. Debendra K. Das

4. **Text**: Heating, Ventilating, and Air Conditioning, by F.C. McQuiston, J.D. Parker and J. D. Spitler, 2005.
   a. Other supplemental materials: None

5. **Specific course information**

   a. **Catalog Description**: Introduction to the design of power and space conditioning systems, energy conversion, heating, ventilating, air conditioning, total energy systems, and introduction to thermal system simulation and optimization.

   b. Prerequisite: ES 346 and ES 341

   c. Elective course in mechanical engineering program

6. Specific goals for the course

(i) To provide the students knowledge of thermal systems used in buildings. Upon completing this course, the students will be able to apply the mathematical, scientific and engineering principles for designing the heating, cooling and ventilating systems of residential and commercial buildings. The students will also be able to explain the significance of current research in developing energy efficient building thermal systems.

(ii) This course addresses the following student outcomes of **ABET Criterion 3.**

(a) an ability to apply knowledge of mathematics, science, and engineering.
(c) an ability to design a system, component, or process to meet desired needs
(e) an ability to identify, formulate, and solve engineering problems.
(f) an understanding of professional and ethical responsibility.
(g) an ability to communicate effectively.
(j) a knowledge of contemporary issues.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) an understanding of northern issues.

7. Brief list of topics to be covered

Introduction, HVAC units, energy, power, fundamental concepts of heating and cooling

Dehumidifying, Humidifying, Controls, HVAC components, Air systems, Water systems, Heat pumps, Heat Recovery, Thermal storage

Moist air equations, Adiabatic saturation, Wet bulb temp., Psychrometric chart

Space air conditioning, Design conditions, Sensible heat factor, Adiabatic mixing of streams

Indoor environmental quality, Comfort, Contaminants, Control methods

Heat transmission in building structures**,** Overall heat trans. coefficients, moisture transmission

Infiltration, Supply air, Computer calculation of heating load

Solar equations, ASHRAE model, Fenestration & Energy calculation

Heat gain, cooling load calculation procedures, internal gains, Heat Balance method and Radiant Time Series method

Building energy need calculation, Degree day procedure

Hydronic systems, Flow, pumps and piping, Piping systems fundamentals, Piping system design

Air systems, Space air diffusion, Jet behavior, Air distribution system design

Fan equations, Air flow in ducts and fittings, duct design-sizing chart.

1. ME 416 – DESIGN OF MECHANICAL EQUIPMENT FOR THE PETROLEUM INDUSTRY

2. Three credits, three contact hours per week

3. Instructor: Dr. Debendra K. Das

4. Text book: None

a. Other supplemental materials:

Class handouts and references will be given from the following books and other sources.

(1)Fundamentals of Engineering Thermodynamics by M. Moran and H. Shapiro, 3rd Edition, John Wiley

(2) Fluid Mechanics by F. M. White, 2nd Edition, McGraw-Hill

(3) Equipment Design Handbook, Vol. 1 & 2 by F. E. Evans, 1st Ed., Jr., Gulf Publis. Co.

(4) Fund. of Heat Transfer by F. P. Incropera & D. DeWitt, 2nd Edition, John Wiley

(5) Principles & Applications of Electrical Engineering by G. Rizzoni, 1st Ed., Irwin Inc.

(6) Intro. to Materials Science for Engineers by J. Shackelford, 6th Edition, Prentice Hall

5. Specific course information

a. **Catalog Description**: Design, selection and operation of equipment used in production and processing of crude oil and gas. Instrumentation and control systems used with mechanical equipment.

b. Prerequisite: ES 346 and ES 341

c. Elective course in mechanical engineering and petroleum engineering programs

6. Specific goals for the course

(i) To provide the students knowledge about the mechanical equipment used in the petroleum industry. Upon completing this course, the students will be able to apply the mathematical, scientific and engineering principles of the engines, turbines, pumps, compressor , electric motors, etc. in the design, selection and operation of such equipment, which are used in production, processing and transportation of oil and gas. The students will also be able to explain the significance of current research in improving the engines, turbines, pumps, compressors and other oil field equipment.

(ii) This course addresses the following student outcomes of **ABET Criterion 3.**

(a) an ability to apply knowledge of mathematics, science, and engineering.
(c) an ability to design a system, component, or process to meet desired needs
(e) an ability to identify, formulate, and solve engineering problems.

(j) a knowledge of contemporary issues.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) an understanding of northern issues.

7. Brief list of topics to be covered

Introduction to different petroleum industry equipment

Engines: Diesel and Gasoline engine thermodynamic cycles, Design considerations

Gas Turbines: Brayton cycle, Steam Turbine: Rankine Cycle, Design considerations

Pumps: Reciprocating oil well pump, Sucker rod and Flywheels design

Centrifugal pumps and other types of pumps, Pump laws, design, selection and NPSH

Compressors: Centrifugal, axial and reciprocating, Cascade system for low temp. gas liquefaction. Natural gas transmission, Design considerations

Electric motors, Different types, Motor theory, design, selection, different applications

Piping and Pressure vessels design, API and ASME piping and PV codes

Pipe joints, Brittle vs. ductile fracture, Crack propagation, Hydrogen cracking, Corrosion

Heat Exchangers, Theory, design, application in oil industry

Instrumentations: Temperature and pressure measurements, Liquid level and flow measurements, Strain gauges, Piezoelectric devices

Different types of valves, applications in oil industry, Control of flow, pressure, temperature and liquid level

Arctic engineering problems, insulation, contraction and thermal stresses, Brittle behavior, viscous lubrication, Loss of compression on gaskets of bolted joints

1. ME 440 –Introduction to Microfluidics

2. 3 credits, Lecture: T/TR 1130am – 1pm, no lab hour.

3. Instructor: Cheng-fu Chen (ME)

4. Intructor's notes (400+ pages).
Lecture slides and other reading materials are also posted on Blackboard for students learning.

5. Specific course information
   a) Catalog description: Overview of basic concepts and principles of fluids at the micron scale; introduction to the design and fabrication of microfluidic devices; discussions of design, fabrication, and applications of microfluidic devices.
   b) Prerequisite: PHYS 211X (for engineering, math and physics major) or PHYS 103X (for math and non-physics science major); junior standing or higher.
   c) Elective course

6. Specific goals for the course
Overview the principles of microfluidics and introduce the design and fabrication of microfluidic devices (pumps, valves, mixing devices, sorting devices, etc) and their applications (mixing, sorting, metering, etc.) in the fields of engineering and bioengineering.

7. Brief list of topics to be covered
Introduction
Review of fluid mechanics
Life at low Reynolds number
Diffusion and random walk
Dispersion
Applications:
    Droplet production
    Mixing at low Reynolds number
    Taylor dispersion
    Separation at low Reynolds number
    Porous-medium diffusion
    Microfluidic device design and fabrication

1. Course number and name: ME F415 Thermal Systems Laboratory

2. Credits and contact hours: 3 Credits
Wed (lecture) 8:00 – 9:30 am
Thu (Lab, Section F01) 14:00 -17:10
Fri (Lab, Section F02) 14:15 – 17:25

3. Instructor: Dr. Sunwoo Kim
Room 337A, Duckering
Phone: 474-6096
Fax: 474-6141
E-mail: swkim@alaska.edu
Office hours: W, R, F 11:00 – 12:00

4. Textbook
ME 415 Thermal Systems Laboratory Manual

5. Course description
Testing and evaluation of components and energy systems such as pumps, fans, engines, heat exchangers, refrigerators, and heating/powerplants.

Prerequisites: ENGL 111X, 211X, or 213X, ES 341, ME 308, ME 313, ME 441

6. Course goals
The student will gain hands-on experience by demonstrating the principles learned in previous studies concerned with heat transfer, fluid mechanics, and energy systems through the use of laboratory experimentation. He/she will also learn experimental procedures that will be useful in an engineering career.

ABET Criteria 3 – Program outcomes
This course helps students meet outcomes:
(a) an ability to apply knowledge of mathematics, science, and engineering
(b) ability to design and conduct experiments, as well as to analyze and interpret data.
(g) ability to communicate effectively.
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) an appreciation of significant engineering issues in the North.

7. Topics and course schedule

The course schedule shall be approximately as shown below. Some adjustment may be made.

Week	Topic	Lecture	Lab
1	Course introduction	Du 352	No lab
2	Transient heat transfer	Du 352	Du 103
3	Low temperature viscosity	Du 352	Du 103
4	Temperature profile in rods	Du 352	Du 103
5	Thermal conductivity	Du 352	Du 231
6	Refrigeration performance	Du 352	Du 103
7	Exam 1	Du 352	No lab
-	Spring Break		
8	Centrifugal pump performance	Du 352	Du 231
9	Heat Exchanger Performance	Du 352	Du 231
10	Gas Turbine Performance	Du 352	Du 103
11	Diesel Engine Performance	Du 352	Du 103
12	Heat Exchanger Design Project	Du 352	No lab
13	Heat Exchanger Design Project Continues	No lecture	No lab
14	Exam 2	Du 352	HW10

1. Course number and name: ME F441 Heat and Mass Transfer

2. Credits and contact hours: T, R 11:30 - 1:00 (3 credits)

3. Instructor: Dr. Sunwoo Kim
Room 337A, Duckering
Phone: 474-6096
E-mail: swkim@alaska.edu
Office hours: T, R 3-4 pm

4. Textbook

Y.A. Cengel, *Heat and Mass Transfer*, 4th ed, McGraw Hill, 2010

Recommended reading materials

A. Bejan, *Heat Transfer*, Wiley.
F.P. Incropera, D.P. DeWitt, *Fundamentals of Heat and Mass Transfer*, 6th Ed. (5th Ed.), Wiley, New York.

5. Course description

Fundamental concepts of heat and mass transfer including steady state and transient conduction, laminar and turbulent free and forced convection, evaporation, condensation, ice and frost formation, black body and real surface radiation, and heat exchangers.

Prerequisites: ES 301, ES 341, ES 346

6. Course goals

The student will be able to

- use analytical and numerical techniques for solving heat conduction problems
- understand how to calculate convective heat transfer rates with and without buoyancy effects
- appreciate some of the calculations needed to design heat exchangers
- explain the boiling and condensation phenomena

ABET Criteria 3 – Program outcomes

This course helps students meet outcomes:

(a) an ability to apply knowledge of mathematics, science, and engineering
(c) an ability to design a system, component, or process to meet desired needs
(e) an ability to identify, formulate, and solve engineering problems
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) an appreciation of significant engineering issues in the North

7. Topics and course schedule

Week	Topic	Textbook	Homework
1	Introduction: fundamental concepts	CH. 1	
2	Three types of heat transfer	CH. 1	HW1
3	Heat conduction equation	CH. 2	HW2
4	Unidirectional steady conduction	CH. 3	HW3
5	Applications: cooling fins	CH. 3	HW4
6	Quiz No. 1 & review Quiz 1		
7	Time-dependent conduction	CH. 4	HW5
8	Numerical methods for conduction	CH. 5	
9	Fundamentals of convection	CH. 6	HW6
10	External forced convection	CH. 7	HW7
11	Quiz No. 2 & review Quiz 2		
12	Internal forced convection	CH. 8	HW8
13	Natural convection	CH. 9	HW9
14	Phase changing heat transfer	CH. 10	
15	Heat exchangers	CH. 11	HW10
16	Final exam		

ME 450 Theory of Flight
University of Alaska Fairbanks
Fall 2010

Lecture hours and Credits

Thu 4 – 7 pm Duckering 347, 3 credits

Instructor

Prof. Jifeng Peng
Office: Duckering 329
Tel: 474-7399
Email: jf.peng@alaska.edu

Textbook

Introduction to Flight, John D. Anderson, 6th Edition, McGraw Hill, 2008

Course Description

- Airfoil theory in subsonic flow. Performance, stability and control of aircraft. Aircraft design.
- Prerequisite: ES 346. Co-requisite: ES 341.
- This course is an elective course.

Course Goal

This course is intended to introduce students to some basics of airfoil theory in subsonic flow, flight performance, stability, control of aircraft, and aircraft design. The goal of this course is to help students achieve understandings in the following:

- How to determine the coefficients of lift and drag and how these parameters are used to calculate the lift and drag forces.
- How lift, drag, thrust, and weight are interrelated for flight.
- How control surfaces (e.g.; flaps, ailerons) affect lift and drag and thus allow the aircraft to maneuver (e.g.; roll, pitch, yaw).
- How design choices affect aircraft performance such as rate-of-climb, take-off & landing distance, and maximum service ceiling. Also, how forces acting on the aircraft and aircraft functionality must be considered during design.

Abet outcomes

- an ability to apply knowledge of mathematics, science, and engineering.
- 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.
- an ability to identify, formulate, and solve engineering problems.
- an ability to communicate effectively.
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Calendar and Topics

Week	Topic	Reference
1	Course Introduction	
2	Fundamentals	Chapter 2
3	The Standard Atmosphere	Chapter 3
4 – 5	Basic Aerodynamics	Chapter 4
6 – 8	Airfoils, Wings and other Aerodynamic Shapes	Chapter 5
9	Midterm Exam	
10 – 11	Elements of Airplane Performance	Chapter 6
12 – 13	Principles of Stability and Control	Chapter 7
14	Propulsion Systems	Chapter 9
15	Flight Vehicle Structures and Materials	Chapter 10
16	Final Exam	

ME 451 Aerodynamics
University of Alaska Fairbanks
Spring 2011

Lecture hours and Credits

Mon 5:20 – 8:10 pm Duckering 347, 3 credits

Instructor

Prof. Jifeng Peng
Office: Duckering 329
Tel: 474-7399
Email: jf.peng@alaska.edu

Textbook

Fundamentals of Aerodynamics, John D. Anderson, 5th Edition, McGraw Hill, 2010

Course Description

- Aerodynamics of non-lifting and lifting airfoils in incompressible irrotational flow, wings of finite span, the Navier-Stokes equations, boundary layers, numerical methods, supersonic and transonic flow past airfoils, rocket aerodynamics, rocket drag.
- Prerequisites: ES301, ES 341, ES 346. Co-requisite: ME 313.
- This course is an elective course.

Course Goal

This course is intended to introduce students fundamental aerodynamics theories on performances of wings and bodies in sub/supersonic regimes. The goal of this course is to help students achieve understandings in the following:

- model the flow fields around aerodynamic bodies.
- formulate and apply appropriate aerodynamic models to predict the forces on aircraft wings.
- perform simple aerodynamic analysis and design.

Abet outcomes

- an ability to apply knowledge of mathematics, science, and engineering.
- 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.
- an ability to identify, formulate, and solve engineering problems.
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Calendar and Topics

Week	Topic	Reference
1	Course Introduction; Forces, Moments, & Flight Basics	Chapter 1
2	The Fundamental Principles Governing Aerodynamics	Chapter 2
3 – 4	Aerodynamics for Inviscid, Incompressible Flow	Chapter 3
5	The Aerodynamic Analysis of Incompressible Flow Over Airfoils	Chapter 4
6	Lifting Flow Over Airfoils	Chapter 4
7	Midterm	
8	Spring Break	
9	Lifting Flow Over Airfoils	Chapter 4
10 – 11	Aerodynamic Analysis of Flow Over Finite Wings	Chapter 5
12 – 13	3-D, Incompressible Flow	Chapter 6
14	Introduction to Inviscid, Compressible Flow	Chapter 7
15	Introduction to Shock & Expansion Waves	Chapter 8, 9
16	Final Exam	

1. ME 452 - Astrodynamics

2. 3 credits, Lecture: MWF 11:45am-12:45pm, no lab hour.

3. Instructor: Cheng-fu Chen (ME)

4. Intructor's notes (400+ pages).
Roger R. Bate, Donald D. Mueller, and Jerry E. White, Fundamentals of Astrodynamics. Dover Publications, Inc., New York, 197.

5. Specific course information
   a) Catalog description: Geometry of the solar system, detailed analysis of two-body dynamics and introduction to artificial satellite orbits; Hohmann transfer and patched conics for lunar and interplanetary trajectories. Elements of orbit determination.
   b) Prerequisite: ES 208 or ES 210; and ES 301.
   c) Elective course

6. Specific goals for the course
To understand and apply Kepler's laws to motion of celecial objects and design of artifrafts.

7. Brief list of topics to be covered
   - Central-force problems
   - Conic section – review
   - Orbit equation
   - Orbit determination
   - Basic orbit maneuvers
   - Two-body orbital boundary-value problems
   - Ballistic missile orbits
   - Lunar orbits
   - Interplanetary orbits

1. ME 453 – PROPULSION SYSTEMS

2. Three credits, three contact hours per week

3. Instructor: Dr. Debendra K. Das

4. Text book: "Mechanics and Thermodynamics of Propulsion," by Phillip G. Hill and Carl R. Peterson, 2nd Edition, Addison-Wesley Publishing Co.

a. Other supplemental materials:
(i) "Fundamentals of Engineering Thermodynamics" by M. Moran and H. Shapiro, 3rd Edition, John Wiley
(ii) "Rocket Propulsion Element," by George P. Sutton, 6th Edition, Wiley Interscience

5. Specific course information

a. **Catalog Description**: Basic principles of propulsion: turbojet, turboprop and rocket engines. Fluid mechanics and thermodynamics of flow in nozzles, compressors, combustors and turbines. Liquid and solid propellant rockets. Heat transfer in rocket motors and nozzles. Design and testing methods for components of propulsion systems.

b. Prerequisite: ES 341 and ME 313

c. Elective course in mechanical engineering

6. Specific goals for the course

(i) To provide the students knowledge about the aerodynamic and hydrodynamic propulsion systems. Upon completing this course, the students will be able to apply the mathematical, scientific and engineering principles related to propellers in aircrafts and ships, jet engine driven planes and rocket propulsion of missiles and space crafts. The students will also be able to explain the significance of current research in improving the jet and rocket propulsion systems.

(ii) This course addresses the following student outcomes of **ABET Criterion 3.**

(a) an ability to apply knowledge of mathematics, science, and engineering.
(c) an ability to design a system, component, or process to meet desired needs
(e) an ability to identify, formulate, and solve engineering problems.

(j) a knowledge of contemporary issues.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

7. Brief list of topics to be covered

Introduction to Jet Propulsion

Mechanics and Thermodynamics of Fluid Flow in propulsion devices

One-Dimensional Gas Flow

Boundary Layer and Heat Transfer

Aircraft Propulsion: Jet Engines, Turbojet, Turboprop, Turbofan and Ramjet Propulsion

Inlets, Combustors & Nozzles

Design Consideration for Rocket Engines

Thrust Chamber, Combustion & Expansion

Hydrodynamic Propulsion of Ships with Propellers and Water Jet

1. **ME F464 Corrosion Engineering**

2. 3 credits, Tue & Thu. 11:30am – 1:00 pm @ DU 333

3. Dr. Jing Zhang (office: 323 DUCK, ext. 6135, jzhang6@alaska.edu)

4. Principles and Prevention of Corrosion by Denny A. Jones, Prentice Hall; 2nd edition (September 29, 1995), ISBN: 0133599930

5. Specific course information
    a. Catalog description: Principles and forms of corrosion and factors that affect it. Methods of testing and measurement, control and prevention are examined.
    b. Prerequisite: ME F334
    c. Elective course

6. Specific goals for the course
    a. The main objectives are (1) Identify the major forms of corrosion and which are of concern for your applications; (2) Relate the occurrence and severity of corrosion to the natural driving forces; (3) Describe common corrosion test methods for your applications; Avoid many of the design traps that speed corrosive decay; and (4) Recognize applicable corrosion control techniques and their limitations.
    b. This course helps students meet student 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.
        (d) an ability to function on multi-disciplinary teams.
        (e) an ability to identify, formulate, and solve engineering problems.
        (g) an ability to communicate effectively.
        (i) a recognition of the need for, and an ability to engage in life-long learning.
        (j) a knowledge of contemporary issues.

7. Brief list of topics to be covered
    Forms of Corrosion, the electrochemical model; Thermodynamics, Pourbaix Diagrams; Kinetics, corrosion currents, Mixed Potential Theory; Passivity, passivation of iron; Electrochemistry, Linear Polarization; Galvanic Corrosion; Pitting and Crevice Corrosion test methods for pitting, theories; Environmentally Induced Cracking; Metallurgical, Intergranular corrosion; Hydrogen, Erosion corrosion; Environments: concrete, soil, and ocean; Atmospheric. Hot oxidation; Cathodic Protection, sacrificial anodes.

1. Course number and name: Senior Design (Design Project) - ME F487
2. Credits and contact hours : 3
   Meetings: W 03:30 --06:30 PM, DUCK 252.
3. Instructor's or course coordinator's name: Gang Sheng (Gang Chen)
4. Text book, title, author, and year
   - P. G. Dominick, J. T. Demel, W. M. Lawbaugh, R. J. Freuler, G. Kinzel, and E. Fromm, "Tools and Tactics of Design," John Wily & Sons, Inc, 2001.
   - David Ullman, The Mechanical Design Process, Mcgraw-Hill, 2002.
   - Instructor notes, handouts and materials that are periodically uploaded on the course web.
5. Specific course information
   A real or simulated engineering design project selected jointly by student and instructor. Enphysis one design of practical engineering systems and/or components which integrate students engineering knowledge and skills.
   Prerequisites: COMM F131X or COMM F141X; ENGL F111X; ENGL F211X or ENGL F213X or permission of instructor; ME F441; senior standing. Co-requisite: ME F403.
6. Specific goals for the course

The course seeks to provide senior student with an integrated and summative design experience. It incorporates the disciplines of mechanical engineering in one project. The course is to understand and exercise design processes and skills for implementing design projects on one hand, and to practice professional and ethical responsibilities on the other. The introduction to the actual design processes and the survey of contemporary design methodologies will be presented. In addition, throughout this course we will be dedicated to inspiration of life-long learning.

7. Brief list of topics to be covered: **Course Contents**
   - Course outline, team formation, projects selection, and find project advisors.
   - Overview of the design process, Problem statement / definition.
   - Design Process 1: Pre-concept; Concept; Formulation of a Design Problem; Customer needs and global perspective, Define project/specifications; Design/development, Pre-prototype, Production; Post lunch
   - Design Process 2: Target setting & cascading; Top-down & Bottom-up Processing; Concept proving and benchmarking.
   - Design Process 3: Design/project management, performance tracking, balance from different levels, functional requirements and analysis, solution processes, evaluation and decision making
   - Special design topic 1: Routine/domain design, innovative design and creative design: Theory of Inventive Problem Solving
   - Special design topic 2: Optimization Design
   - Special design topic 3: Reliability Design
   - Special design topic 4: Robust Design, Failure Mode and Effects Analysis in Design
   - Prototype, Testing/Benchmark, Documentation/ Presentation.

Project Selection Criteria

An eligible project for *Senior Design* must meet **all** of the following criteria:

- Having essential integration of knowledge of mathematics, science, and engineering.
- Having essential achievements and/or vision to satisfy the needs of economy, society, environment, health, safety, security, science, technology, northern issues and/or intellectuality.

- Having essential practice of problem definition, solution formulation, prototyping, and engineering skills.
- Having essential practice of working ethics, team work, project management, communication, etc.
- Will have a prototype tested and demonstrated in the final presentation.
- The projects should be peer defined or reviewed:
  a. Real projects from industry companies or public organizations should be defined/sponsored by experienced engineers/managers.
  b. Club projects should be one of national or regional competitions. The published rules defined by competition peer review committee will be complied.
  c. Faculty defined project that is directly relevant to faculty's research is acceptable and the publications are encouraged.
  d. Student self-defined project should have strong recommendation from adviser who is a peer in the project area or is directly working in the project area.

Course Activities

(1) Class Events
- A schedule of class activities is distributed with this syllabus at the first meeting of the class. It lists the events we will go through during this semester. They include selecting / proposing a design project, forming a team, identifying project advisors, giving presentations, and submitting reports, etc.
- One pre-proposal, one proposal, one progress and one final report and several in-class presentations will be completed.

(2) Class participation is mandatory.

(3) Team Work
- Students need to form a team with 2~4 members to work on a project through the semester. Selection, Content, and Progress of Project
- Students are encouraged to work on funded and/or real projects. No financial support is available from the instructor or the department. Students are encouraged to develop their own funding connections.
- The instructor will introduce several project problems at the first meeting.
- Students may pursue their existing project, which must meet some criteria [see Project Selection Criteria above].
- The selected project must have design contents in nature. You must avoid choosing inappropriate projects (like web page designs, pure analysis/simulations, pure testing, lab equipment setup and testing, or pure manufacturing).

(4) Supervision of Project
- Find one advisor (the instructor, any other faculty advisor at UAF, and/or one professional engineer/technician, etc.).
- Each team keeps the instructor updated every week about your work progress.
- Each team is suggested (but not required) to have a weekly meeting with their advisors to update the design progress.

(5) Reports
- One pre-proposal, one proposal, one progress report, and one final report are to be collected.
- Final presentation/showcase will be given to public in last week.

Appendix A-2 – ES Courses

1. ES 101 – Introduction to Engineering

2. 3 credits, Lecture: MW 10:30am – 11:30am; Lab: W, R, or F: 2:15pm – 4:15pm

3. Instructor: Charlie Mayer (ECE), Jonah Lee (ME), Keith Whitaker (CE)

4. Raymond B. Landis. Studying Engineering: A Road Map to a Rewarding Career, 3rd edition, Discovery Press, 2007.

   b. Other handouts will be provided.

5. Specific course information

   a. Catalog description: Overview of the engineering profession and introduction to the fields of engineering. Basic concepts from engineering, physics and mathematics applied to engineering problem solving. Basic skills required of engineers, including an introduction to engineering communications: word processing, descriptive geometry, orthographic and isometric drawings, graphs, computer graphics and use of spreadsheets.
   b. Prerequisite: MATH 107X; Co-requisite: MATH 108 or calculus placement.
   c. Required course

6. Specific goals for the course

   d. The goals of this course include introducing the field of engineering to the students, including engineering concepts, language, problem solving, reporting, laboratory work, etc. Additionally, students will form 3-4 person teams to design, build and launch water rockets. They will learn about design concepts such as scoping (or brainstorming), alternative and final selection, building (or constructing), competition, lessons learned, and reporting. They will have opportunity to launch their water rockets at a contest in early April. This project is designed to enhance the introductory engineering experience, learn about teamwork, and for students to have fun.
   e. This course helps students meet student outcomes:
      (a) an ability to apply knowledge of mathematics, science, and engineering
      (d) an ability to function on multi-disciplinary teams
      (f) an understanding of professional and ethical responsibility
      (g) an ability to communicate effectively
      (i) a recognition of the need for, and an ability to engage in life-long learning
      (j) a knowledge of contemporary issues
      (l) an appreciation of significant engineering issues in the North

7. Brief list of topics to be covered

   f. Electrical Engineering
      1. Circuits: voltage, current, resistance, power, voltage divider, current divider, Kirchoff's current law

2. Computers: architecture, Boolean logic, gates, combinational logic, number systems, add and multiply
3. Power: efficiency, battery capacity, energy
4. Communications: analog and digital, internet

g. Mechanical Engineering
   i. Aerodynamics
   ii. Power cycles
   iii. Stress/Strain analysis
   iv. Vibrations

h. Civil Engineering
   i. Overview
   ii. Geotechnical
   iii. Structures
   iv. Environmental and water resources
   v. Arctic

1) **ES 201 – Computer Techniques**

2) 3 Credits, Lecture: MW 10:30 – 11:30 am, Lab: M 2:15 – 5:15 pm

3) Instructor: H. Ed Bargar

4) No text.
   a) Class Web site located at: http://medept.engr.uaf.edu

5) Specific course information
   a) Catalog Description: Basic computer programming, in C/C++, with applications from all fields of engineering. Introduction to MATLAB.
   b) Prerequisite: MATH 107X & MATH 108 or Co-requisite: MATH 200X.
   c) Required Course.

6) Specific Goals for the course:
   a) Develop a basic understanding of how computers work with and store information. Concepts of structured programming, which can be applied in many programming languages, are taught using the C++ language. These concepts and more advanced constructs are further developed using the Matlab programming/user environment. Upon completion of this course, the student should be: familiar with how computers utilize memory and file storage and the difference between an interpreted and compiled computer language; able to properly implement the three primary programming structures: sequential, selective, and repetitive; understand how to organize programs into functions for efficient use/re-use and be able to write functions that call other functions; able to design and write computer programs to solve engineering problems.
   b) This course helps students meet outcomes:
      a An ability to apply knowledge of mathematics, science, and engineering.
      e An ability to identify, formulate, and solve engineering problems.
      i A recognition of the need for, and an ability to engage in life-long learning.
      k An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

7) Brief list of topics covered.
   a) Basics of computer memory and file organizations and workings.
   b) The C++ computer programming language and the basics of all structured computer programming languages.
   c) The Sequential Structure in C++ programming.
   d) Selective Structures in C++ programming.
   e) Repetitive Structures in C++ programming.
   f) Task-specific functions and program organization in C++ programs.
   g) File I/O (input/output) using C++.
   h) The Matlab computer operating/programming environment.
   i) Interactive operations using the Matlab environment.
   j) Programming functions in Matlab.
   k) Selective Structures in Matlab.

l) Repetitive Structures in Matlab.
m) File I/O in Matlab programs and interactively from the User Interface.

1. **ES209 – STATICS**
2. 3.0 credits, Lecture: Monday, Wednesday, Friday, 1:00-2:00 pm
3. Instructor: Dr. Margaret Darrow
4. Hibbler, R. C. (2009). *Statics*, 12th ed.: Prentice Hall, Upper Saddle River, New Jersey.
5. Specific course information:
   a) 2010-2011 Catalog Description: Force systems in two and three dimensions. Composition and resolution of forces and force systems; principles of equilibrium applied to various bodies, simple structures, friction, centroids, moments of inertia. Vector algebra used where appropriate.
   b) Prerequisites: ES201. Co-requisites: MATH201, PHYS211
   c) Required course
6. Specific goals for the course
   a) The goal for this course is to introduce the theory and application of engineering statics. To achieve this goal, students will be asked to demonstrate understanding of several topics, such as forces and vectors, rigid-body equilibrium, specific equilibrium applications such as trusses, frames and machines, frictional forces, and center of gravity and centroids.
   b) This course helps students meet outcomes:
      (a) an ability to apply knowledge of mathematics, science and engineering;
      (e) an ability to identify, formulate, and solve engineering problems;
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
7. Brief list of topics to be covered:
   Forces and Vectors
   Equilibrium
   Force Systems
   Moment
   Free-Body Diagrams
   Equilibrium in 2D and 3D
   Trusses, Frames, and Machines
   Internal Forces
   Friction
   Center of Mass
   Moments of Inertia

1. **ES 210 – DYNAMICS**

2. 3 Credits, Lecture MWF (1:00 – 2.00)

3. Instructor: Debasmita Misra

4. Textbook: Hibbeler, R.C. – "Engineering Mechanics – Dynamics", Twelfth Edition, Prentice Hall.

5. Specific Course Information
    a. Catalog Description: The course will cover motion of particles, kinematics, and kinetics of plane motion of rigid bodies, and principles of work and energy, impulse and momentum. Vector methods will be used where appropriate.
    b. Prerequisite: ES 209
    c. Required course

6. Specific goals for the course
    a. The goal of this course is to introduce to the students the kinematics and kinetics of engineering problems and to help them identify, formulate and solve problems using the approaches learnt in this course. The students are also offered group assignments in order to learn working in a group environment.
    b. This course helps students meet student 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
        (e) An ability to identify, formulate, and solve engineering problems

7. Brief list of topics to be covered
    a. Kinematics of Particles
        i. Rectilinear Kinematics: Continuous Motion
        ii. Rectilinear Kinematics: Erratic Motion
        iii. Curvilinear Motion: Rectangular Components; Projectile Motion
        iv. Curvilinear Motion: Normal and Tangential Components
        v. Curvilinear Motion: Cylindrical Components
        vi. Absolute Dependant Motion Analysis
        vii. Relative Motion Analysis
    b. Kinetics of Particles
        i. Equations of Motion: Rectangular Coordinates
        ii. Equations of Motion: Normal and Tangential Coordinates
        iii. Equations of Motion: Cylindrical Coordinates
        iv. Principles of Work and Energy
        v. Power and Efficiency
        vi. Potential Energy and Conservation of Energy
        vii. Principle of Linear Impulse and Momentum
        viii. Conservation of Linear Momentum for a System of Particles
        ix. Impact
        x. Principle of Angular Impulse and Momentum

c. Planar Kinematics of a Rigid Body
    i. Translation and Rotation
    ii. Absolute Motion Analysis
    iii. Relative Motion Analysis: Velocity
    iv. Instantaneous Center of Zero Velocity
    v. Relative Motion Analysis: Acceleration
d. Planar Kinetics of a Rigid Body
    i. Mass Moment of Inertia; Planar Kinetic Equations of Motion: Translation
    ii. Equations of Motion: Rotation about a Fixed Axis
    iii. Equations of Motion: General Plane Motion
    iv. Planar Kinetics of Rigid Body: Work and Energy
    v. Planar Kinetics of Rigid Body: Conservation of Energy
    vi. Planar Kinetics: Impulse and Momentum and Conservation of Momentum

1. ES 301 –Engineering Analysis

2. 3 credits, Lecture: MWF 9:15am – 10:15am, no lab hour.

3. Instructor: Cheng-fu Chen (ME)

4. Numerical Methods for Engineers, Steven C. Chapra & Raymond P. Canale, 6th.edition, McGraw Hill, 2010.

   c. Lecture slides are posted on Blackboard. 20+ numerical functions implemented by the instructor are also uploaded online for students learning.

5. Specific course information

   i. Catalog description: Application of mathematical tools to typical engineering design problems. Selected topics from all fields of engineering.
   j. Prerequisite: ES 201 and MATH 302.
   k. Required course

6. Specific goals for the course

   l. To introduce fundamental numerical methods and numerical skills of using Matlab (which is not required in this class) to process, analyze, and solve engineering problems of the topics listed in Item 7 below.
   m. This course helps students meet student outcomes:
      (a) an ability to apply knowledge of mathematics, science, and engineering.
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

7. Brief list of topics to be covered

   Introduction to error analysis, modeling, and precision.
   Searching methods for finding roots
   Numerical linear algebra
   Optimization
   Curve fitting
   Numerical differentiation
   Numerical integration
   Numerical solutions of differential equations
   Boundary-value problems and eigenvalue problems

1) **ES 307 – Elements of Electrical Engineering**

2) 3 Credits. Lecture: TR 8:00 – 9:30 am.

3) Instructor: H. Ed Bargar

4) "Essentials of Electrical and Computer Engineering" by David V. Kerns, Jr. & J. David Irwin
   a) Class Web site located at: http://medept.engr.uaf.edu

5) Specific course information.
   a) Catalog description: Elementary circuits and theorems; nodal and mesh analysis; transient analysis; ac steady state and power analysis, power compensation; basic electronics; electromechanical systems: magnetic circuits, DC/AC machines and transformers.
   b) Prerequisite: MATH 202X.
   c) Required course.

6) Specific goals for the course.
   a) Electrical Engineering concepts and principles are presented directed primarily to engineering students in other engineering disciplines. Electricity is commonly used to transport energy from one location to another. Electrical machinery is used to transform energy. Electrical circuits are used to control equipment and govern its operation. An understanding of the principles of electrical circuits and electrical machinery is important to all fields of engineering since electrical equipment will be encountered in every field of modern engineering practice. Upon completion of this course, the student shall be familiar with: basic circuit laws including Ohm's Law and Kirchhoff's Law; analyses of AC & DC circuits to determine voltage, current, impedance, and power characteristics. Included is single-phase and three-phase circuit/power analysis; the design and operation of rotating equipment such as generators and motors; control circuits and solid state logic.
   b) This course helps students meet outcomes:
      (a) An ability to apply knowledge of mathematics, science, and engineering.
      (c) An ability to design a system, component, or process to meet desired needs.
      (e) An ability to identify, formulate, and solve engineering problems.
      (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

7) Brief list of topics covered:
   a) DC steady-state circuit analysis and basic laws.
   b) DC transient circuit analysis.
   c) AC steady-state circuit analysis.
   d) AC power analysis.
   e) Magnetic coupling and transformers.
   f) Basic diode and rectifier circuits.
   g) DC generators and motors.
   h) AC generators and motors.
   i) Synchronous machines.
   j) Control circuits and ladder diagrams.

1. ES 331 - Mechanics of Materials

2. 3 credits, Lecture: MWF 1:00pm – 2:00pm

3. Instructor: Yongtao Dong (CEE)

Mechanics of Materials, 5th Ed., F. Beer, E. Johnston, and J. Dewolf, McGraw Hill, ISBN 978-0-07-722140-9

d. Other handouts will be provided.

Specific course information

n. Catalog description: Analysis of internal forces in members subjected to axial, torsional, and flexural loads, or load combinations. Stress-strain relationships and material property definitions; shear and moment diagrams, Mohr's Circle. Applications include beams, columns, connections, indeterminate cases.
o. Prerequisite: ES F208 (Mechanics) or ES F209 (Statics) and MATH F201X (Calculus II).
p. Required course

Specific goals for the course

q. The goals of this course include:
   (a) to develop ability to analyze a given problem in a simple and logical manner;
   (b) to apply a few fundamental and well-understood principles to problem solving;
   (c) to learn analytical techniques for stress and strain under different types of loading;
   (d) to understand how to perform stress/strain transformation and to find the principal stress/strain,
   (e) to develop capability of calculating beam deflection and learn how to draw bending and shearing diagrams to complement the calculation; and
   (f) to introduce students to the concepts of structural stability.
r. This course helps students meet student outcomes:
   (a) an ability to apply knowledge of mathematics, science, and engineering
   (e) an ability to identify, formulate, and solve engineering problems
   (g) an ability to communicate effectively
   (i) a recognition of the need for, and an ability to engage in life-long learning
   (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Brief list of topics to be covered

Chapter 1. Introduction
1.1 Concept of stresses – normal stress
1.2 Shearing stress and bearing stress
1.3 Stress on an oblique plane, stress components

Chapter 2. Stress and strain- axial loading
- 2.1 Normal strain, stress-strain relation, Hooke's Law
- 2.2 Elastic vs. plastic behavior, fatigue
- 2.3 deformation under axial loading
- 2.4 Indeterminate problems, Thermal stress
- 2.5 Poisson's Ratio, generalized Hooke's Law
- 2.6 Shearing strain, relation among E, ν and G,
- 2.7 Saint-Venant's Principle, stress concentration, plastic deformation

Chapter 3. Torsion
- 3.1 Stress and deformation of shaft under torsion
- 3.2 Indeterminate shaft
- 3.3 Noncircular, thin-walled hollow shafts

Chapter 4. Pure Bending
- 4.1 Pure bending, stress
- 4.2 Deformation
- 4.3 Composite members, stress concentrations
- 4.4 Eccentric loading in a plane of symmetry
- 4.5 General eccentric loading

Chapter 5. Beams for Bending
- 5.1 Shear and bending moment diagrams
- 5.2 Relations among load, shear and moment
- 5.3 Design of beam for bending

Chapter 6. Shearing Stresses in Beams
- 6.1 Shearing stress in beams
- 6.2 Longitudinal shear
- 6.3 Shearing in thin-walled members

Chapter 7. Transformation of Plane Stress
- 7.1 Transformation of plane stress
- 7.2 Principal stresses, max. shearing stress
- 7.3 Mohr's Circle for plane stress
- 7.4 Mohr's Circle, examples
- 7.5 Stress in thin-walled pressure vessels

Chapter 9. Deflection of Beams
- 9.1 Deformation of beams
- 9.2 Statically indeterminate beams
- 9.3 Method of superposition

Chapter 10. Columns
- 10.1 Stability of columns
- 10.2 Columns with different end conditions
- 10.3 Design of columns

Chapter 11. Energy Methods
- 11.1 Strain energy & strain-energy density
- 11.2 Elastic strain energy for different stresses
- 11.3 Impact loading
- 11.4 Work-energy method and its application

1. ES 341 – Fluid Mechanics

2. 4 credits, Lecture: MWF 10:30am – 11:30am; Lab: M,T,W, R: 2:15pm – 5:15pm

3. Instructor: Dennis Filler

4. Crowe, C. T., Elger, D. F. and Roberson, J.A. 9th Edition. Engineering Fluid Mechanics. John Wiley & Sons, Inc.

5. Specific course information

s. Catalog description: Statics and dynamics of fluids; energy and momentum principles. Dimensional analysis; flow in open channels, closed conduits and around submerged bodies. Special fees apply.
t. Prerequisites: MATH F201X (Calc II) and ES F208 (Mechanics) or ES F210 (Dynamics).
u. Required course

6. Specific goals for the course

a. 1) Understand basic properties of fluids (extensive, intensive properties).
   2) Understand basic concepts of fluid dynamics (velocity, acceleration, control-volume approach).
   3) Develop the ability to solve problems involving momentum, energy, and similitude principles (continuity, Bernoulli, momentum, Froude, Reynolds, Darcy-Weisbach, etc.).
b. This course helps students meet student 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
   (d) an ability to function on multi-disciplinary teams
   (e) an ability to identify, formulate, and solve engineering problems
   (g) an ability to communicate effectively
   (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

7. Brief list of topics to be covered

a. Fluid properties
b. Fluid statics
c. Flowing fluids
d. Control volume and continuity
e. Momentum and energy
f. Dimensional analysis and similitude
g. Surface resistance
h. Flow in conduits
i. Drag
j. Flow measurements
k. Open channel flow

1) **ES 346 – Basic Thermodynamics**

2) 3 credits, Lecture: TR 9:45 – 11:15 am.

3) Instructor: H. Ed Bargar.

4) "Thermodynamics – An Engineering Approach, 7th Edition"* by Yunus A. Cengel & Michael A. Boles
   a) *The 6th edition may be used in place of the 7th edition.
   b) Class Web site located at: http://medept.engr.uaf.edu.

5) Specific course information
   a) Description: Thermodynamic systems, properties, processes, and cycles. Fundamental principles of thermodynamics (first and second laws) and elementary applications.
   b) Prerequisites: MATH 201X, PHYS 211X.
   c) Required course.

6) Specific Goals for the course:
   a) Basic principles of thermodynamics are covered. These include: properties of pure substances; heat, work, and other forms of energy and energy transfer; and the 1st & 2nd Laws of Thermodynamics. The student will learn: basic engineering problem solving techniques; the concepts of processes, cycles, control volumes, and system boundaries; how to utilize conservation of mass, conservation of energy, and material properties to analyze thermodynamic systems; an understanding of energy efficiency based on the analyses of heat engines and heat, work, & energy systems.
   b) This course helps students meet outcomes:
      a An ability to apply knowledge of mathematics, science, and engineering.
      e An ability to identify, formulate, and solve engineering problems.
      g An ability to communicate effectively.
      k The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
      h An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

7) Brief list of topics covered.
   a) Units and dimensional analysis.
   b) Systems, control volumes and states.
   c) Types of energy.
   d) The 1st Law of Thermodynamics and its relation to energy and energy transfer.
   e) Properties of substances. Property tables and equations of state.
   f) 1st Law analyses of closed systems.
   g) 1st Law analyses of open systems.
   h) The 2nd Law of Thermodynamics.
   i) Sources and sinks.
   j) Reversible and irreversible process and the Carnot Cycle.
   k) Entropy.

Course Syllabus

1. ESM 450W Economic Analysis and Operations

2. 3 credits

3. Billy Connor

4. Engineering Your Future, Second Edition, Stuart G. Walesh, ASCE Press 2000
    a. Course Notes provided by the instructor
    b. Supplemental reading of court cases
    c. Canons of Ethics for each engineering discipline

5. Specific course information
    a. Fundamentals of engineering economy, project scheduling, estimation, legal principles, profession ethics and human relations.
    b. Prerequisites: ENGL F111X; ENGL F211X or ENGL F213X; ES F210 or CS F201; senior standing in engineering; or permission of instructor.
    c. Required for graduation

6. Specific goals for the course
    a. specific outcomes of instruction,
        1) Provide an overview of the engineering profession, including the importance of profession registration, professional development, and good communication.

        1) Understand basic principles of project and quality management.

        2) Understand basic principles of engineering economics.

        4) Understand basic principles of engineering law, with emphasis on contracts and liability; and

        5) Understand the importance of engineering ethics.

    a.

    b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
        1) an ability to apply knowledge of mathematics, science, and engineering;

        2) an ability to design and conduct experiments, as well as analyze and interpret data;

        3) an ability to function on multi-disciplinary teams;

        4) an ability to identify, formulate, and solve engineering problems;

        5) an understanding of professional and ethical responsibility;

        6 an ability to communicate effectively;

        7) a recognition of the need for, and an ability to engage in life-long learning;

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

7. Brief list of topics to be covered
    a. Engineering as a Profession
    b. Management of Self
    c. Communications
    d. Decision Economics
    e. Project Management
    f. Engineering and the Law
    g. Professional Ethics
    h. Working with the Press
    i. Negotiations
    j. Leadership

Appendix A-3 – Math/Science Courses

Course Schedule and Overview

General Chemistry 1 (Chem F105X) 4.0 credits Spring 2011

Lecturer: Professor Thomas Clausen (Reichardt 188, 474-5512; tpclausen@alaska.edu)
Office Hours: MWF 1:00-2:00
Lecture: MWF 2:15-3:15 pm in NSF 201
Text: Chemistry and Chemical Reactivity , 7th Ed. by Kotz; Volume 1
Lab Material: Treichel; Townsend Experiments in General Chemistry (distributed via Blackboard)

Required Materials: Text, OWL access card, Turning Technologies radio frequency clicker; Non- Graphing Scientific Calculator

Course Overview: Chem 105X is the first semester of a two semester series in general chemistry. It meets the American Chemical Society requirements for a introductory course in Chemistry for Science and Engineering majors as well as UAF s core science laboratory requirement(That is what the X implies). In Chem 105X, we will cover chapters 1-11 of the Kotz text. The topics covered include 1) making scientific measurements, 2) atomic theory and atomic structure, 3) stoichiometry, 4) aqueous chemistry, 5) thermodynamics, 6) valence bond theory and molecular orbital theory, 7) introduction to organic chemistry, 8) gas laws.

Course Prerequisites: Placement in ENGL F111X or higher; placement in MATH F107X or higher; or a B or better in CHEM F103X; or permission of instructor and department chair. Students not meeting these prerequisites will be dropped from the course.

Note: A grade of C or better in Chem 105 is required for enrollment in Chem 106.

Additional Course Resources: See the course web page at: www.uaf.edu/chem/courses

Important Dates:

Last day to withdraw with 100% tuition refund	Jan. 28
Last day to drop the course (without a W appearing on transcript; 50% tuition only refund)	Feb. 4
Last day to withdraw from the course (a W will appear on transcript)	Mar. 25

Chemistry Department Policy on Cheating: Any student caught cheating will be assigned a course grade of F . The students academic advisor will be notified of this failing grade and the student will not be allowed to drop the course.

Honor Code:
As a UAF student, you are subject to the Honor Code. The university assumes that the integrity of each student and of the student body as a whole will be upheld. Honesty is a primary responsibility of you and every other UAF student. It is your responsibility to help maintain the integrity of the student community. UAF s Honor Code is as follows:

1) Students will not collaborate on any quizzes, in-class exams, or take-home exams that will contribute to their grade in a course, unless permission is granted by the instructor of the course. Only those materials permitted by the instructor may be used to assist in quizzes and examinations.
2) Students will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself

(direct quotes or paraphrases) in compositions, theses and other reports.

3) No work submitted for one course may be submitted for credit in another course without the explicit approval of both instructors. Violations of the Honor Code will result in a failing grade for the assignment and, ordinarily, for the course in which the violation occurred. Moreover, violation of the Honor Code may result in suspension or expulsion.

Instructor s Expectations: Your attendance and attention (no sleeping!!!) at lecture are expected. Please be respectful of other students. Arrive on time and conduct yourself in a business-like and professional manner. If you arrive late, please enter at the back of the auditorium. Have cell phones turned off unless you are expecting an emergency phone call.

Homework (Active Learning): Homework assignments will be executed using a computerized system called OWL (On-line Web-based Learning). OWL will post assignment deadlines and store homework grades automatically. Students are responsible for keeping track of assignment deadlines. Success in Chem 105 requires practice doing problems. Higher achievement on exams is usually a direct result of time spent doing homework assignments in their entirety.

Each OWL homework set will have a list of optional and required problems. The optional problems will not be used in calculating your final grade. You need only master four (4) required units per chapter to obtain 100% credit; doing more than the four required units is strongly encouraged but will not be used in your grade calculation. The following rules apply:

- Units must be mastered before the due date for credit; there will be no extensions granted
- You have two (2) attempts to master a unit. Note that once you open a unit, that will be considered an attempt regardless of whether you proceed with the problem.
- OWL will provide excellent feedback on how to solve the problem. Be sure to fully understand the feedback on any missed unit before you proceed with your second and final attempt.
- You may make up an unmastered unit by either:
  - mastering another required unit in the same homework set on time
  - mastering three additional units from any chapter. There is no restriction on the number of attempts or due dates in doing these additional units other than they must be done by the last day of classes.

Clickers: We will use classroom response systems (clickers) to take attendance and to ask questions periodically throughout lectures. On days I may opt for a graded quiz using clickers rather than collect notes (see below). ALWAYS BRING YOUR CLICKER TO CLASS.

To register your clicker, send me an email (tnclausen@alaska.edu) with your name and the 6-digit code that is under the bar code on the back of your clicker. **Students failing to register for OWL or failing to register their clicker by Jan. 31st will be dropped from the course for failure to participate in the course.**

Calculators: Always bring your **non-graphing** calculator to class.

Notes from reading assignments: Lectures are much more valuable when you arrive prepared. One good way to do so is to study the text material prior to the lectures. I will expect to find evidence that you have done this by collecting notes prior to each lecture for the reading assignments. The following rules apply:

- Notes are to be turned in at the start of lecture
- Clearly state at the start of your notes your name and what sections of the text are being covered.

- Notes are to be original hand written. No Xerox or electronic versions will be accepted
- Notes will be graded on
  - neatness (3pts for very good; 2 pts for adequate; 1 pt for subpar)
    - penmanship
    - organization (no clutter)
    - standard paper (8.5 x 11 inch) and not torn from a spiral notebook
  - Content (9pts. I will randomly choose three items from the following categories and give up to 3 points per item)
    - key definitions
    - important concepts
    - key mathematical relationships in which each term is defined as well as the numerical value of constants with their units
    - Balanced chemical reactions that have clearly important implications for society or the environment (Haber process; acid rain, sulfuric acid production). Be sure to briefly state why the reaction is important.
    - Worked in-chapter problems
    - In-chapter stories (a closer look ; chemical perspectives , case-studies).

I will strive to have your notes returned to you in the following class period.

In some cases I may choose to have a graded clicker quiz instead of collecting notes. In these instances, the quiz will be open note but closed book.

Exams: There are three scheduled in-class hour exams during the semester plus a cumulative final. All exams count toward your grade; **there are no dropped or make-up exams**. If you can anticipate an absence, talk to me before the exam to make arrangements. If the absence is unexpected (illness, transportation problems, jail time), contact me *ASAP* by phone or email to see if anything can be done. **Do <u>not</u> wait until the next class to speak with me about a missed exam**.

Laboratory: An important component of Chem 105 is a weekly three-hour laboratory session. The purpose of the lab is to reinforce lecture concepts through hands-on investigation. Lab sessions help students to learn about the safe handling of chemicals and the use of common lab equipment. In addition, students are introduced to the concepts of scientific reasoning and experimental design. The labs will be supervised by graduate and upper division undergraduate teaching assistants. Teaching assistants will have specific office hours during which they will be available to answer questions related to the lab assignments. More than 10 experiments are scheduled during the semester. The laboratory portion of your grade will be based on the average of your best 10 lab reports (Note that the first two lab sessions are required for all students). All students enrolled in Chem 105 must attend laboratory. **Students completing (including turning in reports) fewer than 8 lab exercises will fail the entire course.** Lab reports will be handed in each week, to be graded and returned by the teaching assistants. Lab reports are due one week after a lab is completed. Late lab reports will not receive full credit. Your lab TA will explain the penalties for late lab reports.

American Chemical Society Standardized Placement Exam: During the first week of laboratory (Jan. 24 28), a multiple choice placement examination will be given. This exam does NOT count toward your grade, but taking this exam is mandatory. **Any student who does not take this exam will be dropped from the enrollment.** You will be given 45 minutes to answer 44 questions.

Note: <u>The first scheduled lab exercise (Safety Lab) is scheduled for the week of Jan 31 Feb 4</u>. **Attendance at the safety lab is mandatory. You may not continue in the course unless you have attended and turned in the write-up for the safety lab.**

Grading: Your knowledge of the course content will be assessed via a combination of exams, homework, laboratory and in-class exercises. Points for the various exercises will be assigned as shown below.

3 Hour exams @ 100 points each	300 pts
Final exam	100 pts
OWL (homework)	100 pts
Laboratory Total	100 pts
Notes (or quizzes)	100 pts
	700 pts

Total point percentages of 90, 80, 70 and 60 correspond to the lower cutoff boundaries for the grades of A, B, C and D respectively. Plus / minus grades will not be assigned. Percentages less than 60 constitute a failing grade (F).

Note: Students completing (including turning in reports) fewer than 8 lab exercises will receive an F for the entire course egardless of how they are doing in the rest of the course. If absenteeism is due to a documented illness or other accepted reasons, an incomplete may be considered.

Student Responsibilities:
Students are responsible for all material covered in class lecture. If you miss class for any reason, you will need to find out what you missed (generally, this is best accomplished by asking another student in the course for class notes). Students are responsible for reading the assigned material in the text ***before*** coming to class. Clicker questions will be based on reading assignments. Check your email regularly for updates and regularly check and adhere to the due dates for new OWL assignments. Students should keep all returned, graded assignments until after final course grades have been posted on UAonline.

Be sure to come to labs on time, prepared (having completed the prelab) and properly attired. There will be a host of safety rules (eye protection is required, no eating / drinking in lab, no unauthorized visitors) that will be strictly enforced by the laboratory coordinator, Emily Reiter (e.reiter@alaska.edu; 474-6748). In addition, make sure all lab reports are in your own words; plagiarism is a serious offense!

Course Goals
Students should exit the course with the following skills:

- quantitative dilution problems
- an introductory level of understanding of the scientific method
- an introductory level of understanding of chemical nomenclature
- an introductory level of understanding of atomic structure
- an introductory level of understanding of chemical bonding and reactions (redox, acid/base, precipitation, gas formation & combustion)
- an introductory level of understanding of chemical energetics
- an introductory level of understanding of gas laws

Student Learning Outcomes

Student learning outcomes will be assessed via an assessment exam given at the beginning and end of the semester and a standardized final exam.

Disability Services (http://www.uaf.edu/disability/index.html)
Students with a physical or learning disability, who may need academic accommodations, should contact the Disability Services office, located in the Center for Health and Counseling (474-5655, TTY 474-1827, fax: 474-5688.) You will need to provide documentation of your disability. Disability Services will then notify the instructor of any special accommodations required for students with documented learning disabilities.

Chemistry 105 **Lab Schedule** **Spring 2011**

Week	Dates	Laboratory Experiments
1	Jan 24-28	American Chemical Society Standardized Placement Exam (**Mandatory Attendance)**
2	Jan 31- Feb 4	Safety Lab (**Mandatory Attendance)**
3	Feb 7-11	Intro to Lab Techniques
4	Feb 14-18	Reactions in Aqueous Solution
5	Feb 21-25	ID of an Unknown Substance
6	Feb 28-Mar 4	Cycle of Copper Reactions
7	Mar 7-11	Enthalpy of Neutralization
8	Mar 14-18	**No Lab** (Spring Break)
9	Mar 21-25	Intro to Spectroscopy
10	Mar 28-Apr 1	Spectroscopy & Water Hardness
11	Apr 4-8	Isotopes and GC/MS
12	Apr 11-15	Computational Chemistry
13	Apr 18-22	Synthetic Chemistry (Aspirin)
14	Apr 25-29	Standardized post-test **Mandatory Attendance** (Extra Credit will be awarded for this exercise)

Chemistry 105 **Tentative Class Schedule** **Spring 2011**

Week	Date	Day	Chapter	General Topics
0	Jan 21	F		Course Overview
1	Jan 24 Jan 26 Jan 28	M W F	1	Compounds, molecules, Chemical/Physical Properties Review of Math, Precision, Accuracy Graphs, Atomic Structure, isotopes
2	Jan 31 Feb 2 Feb 4	M W F	1	Let s Review: The Tools of Quntitative Chemistry (pp 24-42)
3	Feb 7 Feb 9 Feb 11	M W F	2	Periodic Table, Naming of Compounds, Moles Moles, % composition, hydrated compounds
4	Feb 14 Feb 16 Feb 18	M W F	3	Chemical equations, Balancing chemical equations, Equilibrium Reactions in Aqueous Solutions,Types of Chemical Reactions, Review
5	Feb 21 Feb 23 Feb 25	M W F	4	**EXAM 1** (Chapter 1, 2, & 3) Stoichiometry, Calculations
6	Feb 28 Mar 2 Mar 4	M W F	4 5	Concentration, pH, Spectrophotometry Intro to Chemical Energetics, Specific Heat, Phase Changes, Enthalpy
7	Mar 7 Mar 9 Mar 11	M W F	5	Calculations and Thermodynamic of Reactions
8	Mar 14-18	M-F		**Spring Break**
9	Mar 21 Mar 23 Mar 25	M W F	6 7	EM Radiation, Quantization, Line Spectra Quantum Mechanics, orbitals, electron spin Pauli Exclusion Principle, Exam Review
10	Mar 28 Mar 30 Apr 1	M W F	7	**EXAM 2** (Chapters 4-6) Electron Configurations, Ions, Periodic trends
11	Apr 4	M	7/8	Finish up Ch. 7, Covalent Bonds, Lewis Structures, Formal Charges, Molecular

	Apr 6 Apr 8	W F	8	Shape, bond polarity
12	Apr 11 Apr 13 Apr 15	M W F	9	Bond Properties, Bonding Theory, Valence Bond Valence Bonding, Molecular Orbitals, Exam Review
13	Apr 18 Apr 20 Apr 22	M W F	 11	**EXAM 3** (Chapters 7-9) Gases & Gas Laws
14	Apr 25 Apr 27 Apr 29	M W F	11 10	Chemical Reactions, Partial Pressures, Kinetic molecular theory Intro to Organic Chemistry
15	May 2 May 4 May 6	M W F	10	Functional Groups, Polymers Exam Review
16	May 9	M		**COMPREHENSIVE FINAL EXAM** (1:00 3:00 pm)

1-19-2011

Chemistry 106X **General Chemistry II** **Spring Semester 2011**

Instructor: Dr. John Keller (Office: 161 NSF; Tel 474-6042, email jwkeller@alaska.edu)
Laboratory Director: Emily Reiter (Office 194A NSF; Tel 474-6748; email e.reiter@alaska.edu)
and Teaching Assistant Supervisor
Administrative Assistant: Mist D'June-Gussak .Office 194 NSF; Tel 474-5510; email mist@alaska.edu)
Class Meeting: TR, 6:30-8:00 PM 201 Reichardt
JK Office Hours: TR 8-9 PM; others by appointment

Resources

Required Materials:

1) *Chemistry and Chemical Reactivity 7th Ed.*; Kotz, Treichel, and Townsend, Brooks/Cole; 2009 Volume 2 (ISBN 978-0-495-38712-6) or Complete text 7th Ed. (ISBN 978-0-495-38703-9) or e-Book
2) Access to Chapter 10 (Organic Chemistry), Kotz et al 7th Ed. Either in Vol. 1, or via e-Chapter from http://www.cengagebrain.com/shop/ISBN/9780495387039?cid=APL1 ($8.49)
3) OWL access card for *Chemistry and Chemical Reactivity 7th Ed* (1-semester or 2-semester)
4) A Turning Technologies ResponseCard R_F radio frequency clicker. (new or used OK)
5) *Experiments in General Chemistry 106X: A Laboratory Manual* (Free! available on Blackboard website.)
6) American Chemical Society (ACS) General Chemistry Study Guide
7) A non-programmable non-graphing scientific calculator is required for **each exam**. N.B. The Department of Chemistry and Biochemistry does not provide calculators in exams. You must provide your own. Please do **not** bring a graphing and/or programmable calculator such as a TI-83 to Chem 106X exams.

Optional Texts:
Chemistry & Chemical Reactivity - Student Solutions Manual. Kotz
Chemistry & Chemical Reactivity - Study Guide. Kotz
Essential Algebra for Chemistry Students, 2nd Ed. David W. Ball.

Email communication. All messages will be sent to student UAF email address (like alincoln44@alaska.edu). According to UAF policy, it is the student's responsibility to read or monitor this email account.

Course Overview: Chemistry 106X is the 2nd semester of a two-semester series in general chemistry, which deals with a variety of microscopic and macroscopic chemical phenomena. These courses emphasize the quantitative, mathematical (but mostly non-calculus based) chemistry. Chem 106X covers chapters 10, 12-20, 22-23 of the text. A schedule of lecture topics and assignments is provided on another sheet. Chem 106X satisfies UAF's Core Curriculum in science (that is what the "X" refers to).

Course Goals and Student Learning Outcomes: The goals for this course are to enhance your skills in critical reading, problem-solving, laboratory experimentation, communication of information, self-confidence, and self-reliance.

Chem 106X Homepage: http://chem.uaf.edu/keller/Courses/106Sp11/ The homepage includes links to the syllabus, lecture schedule, practice exams and solutions, copy of lecture notes, and others. There may also be materials, information, and grades available at the Blackboard site for this course (http://classes.uaf.edu/)

Online Web Learning (OWL): Homework problems will be done using the OWL system. The link to the OWL registration page is shown below or can be found on the course homepage. You must obtain an OWL card at the bookstore or online. 1/7 of your grade is based on OWL homework.

OWL: Make sure you register for Chem106X Spr 2011 EVE" . More instructions in the use of OWL will be given in class. OWL questions will be due 1-to-3 days after the chapter has been discussed in class, generally twice weekly. Students will have **6 chances** to solve assignment questions. At the end of the semester, your total OWL points on required questions will be scaled to 80 points and added to the semester total.

"Active learning" means DOING something with your **hands and brain** to put into practice a concept you have just read or heard about. Do a problem related to the reading you have just done. You will learn a lot more, a lot faster, if you DO something after you read or think about it. In class, TAKE NOTES! During the weekly lectures, we will do occasional "clicker questions", which are multiplechoice questions that you answer with your clicker. If you have been following the lecture, and doing some pre-study, these should not be too hard. Some will be easy, and some will be challenging. Other avenues for active learning are doing OWL, in-chapter Exercises, or end-of-chapter Study Questions. The *answers* to the odd-numbered end-of-the-chapter questions may be found in Appendix O of the text. The *stepwise solutions* to the odd-numbered questions are in the *Student Solutions Manual*.

Policies

Prerequisites: (UAF Catalogue): "C" grade or better in Chem 105X; placement in Eng 111X or higher; placement in Math 107X or higher; or permission of instructor and department chair.

Classroom Expectations of Students: JK expects you to attend class, and will check your attendance using clicker scores (see below). Each day BEFORE class, the student should read the portion of the textbook that is assigned on the schedule, and begin to work with the assigned OWL questions (see assignment sheet). With this preparation, you will better be able to understand the discussion, ask questions, and answer "clicker questions" (see below). Please conduct yourself in a business-like and professional manner. Be respectful of the rights other students to a quiet and uninterrupted learning experience. If you arrive late, please enter at the *back* of the auditorium (2nd floor level). **Turn off your cell phone ringer. Put away your laptop. Be quiet. Listen.**

Clickers: Student clicker responses are recorded electronically by the TurningPoint receiver and software on JK's laptop. Questions will be graded 1 point for anansw er, 0 points for no answer. The percent maximum score at the end of the semester will be multiplied by 70 pts and included in the semester total. **About 50 questions will be asked this semester. You will be allowed 5 to 10 zero clicker scores without penalty, to take into account the (hopefully few) days you miss class due to travel on University business, sickness, or your clicker batteries ran down, or other legitimate causes.** No "makeup clicker questions" will be given. No answers on paper can be accepted.

It is the student's responsibility to bring the clicker to each class, take care of it, replace it if lost, and keep it supplied with fresh batteries (they should last the whole semester with normal usage).

Clicker by proxy is a no-no. **Click only you own clicker!**

Register your clicker ID on the OWL website. Go "Clicker Registration" in the Support & Miscellaneous panel on the left had side. **To gain credit on the very first clicker question, your clicker ID must be registered by MONDAY, Jan. 31, 6:00 PM.**
If you miss that deadline, then send your clicker ID to JK as soon as possible.

Laboratory: The purpose of the lab is to do hands-on investigation. We expect you to gain skills in scientific reasoning, experimental design, and use of chemicals and laboratory apparatus. The labs are conducted by graduate and upper division undergraduate teaching assistants. Lab reports will be handed in each week, to be graded and returned by the teaching assistant. 11 experiments are scheduled for the semester. The laboratory portion of your grade (100 points) will be based upon the average of your best 10 out of 11 lab grades. You can miss one lab with no impact on your lab grade. If you miss 2 or 3 labs, then 1 or 2 zeros respectively will be included in the average. **Do not miss 4 labs: this results in a COURSE F!**

All students enrolled in Chem 106X (even those who have taken the course before) must attend laboratory. **Students must hand in 8 or more reports to earn a passing grade in this course. In other words, if you hand in only 7 (or fewer) lab reports, an F grade in the course is assigned, even if all your other grades are passing.** This stiff requirement is based on the American Chemical Society stipulation that students must spend a certain number of hours in lab for courses such as Chem 106X (and of course you must attend lab in order to write a lab report!) There are no make-up labs scheduled during the semester. If you have special scheduling problems or if you miss more than one lab for an acceptable reason, please discuss alternative plans with Emily

Reiter, Laboratory Director. Laboratory reports are due one week after a lab is completed. Late reports will be accepted, but the score will be reduced significantly. The last report of the semester cannot be accepted late.

Exams: The student is responsible for all information from text, lecture, OWL, and assigned study questions. Questions from any of these sources may appear on exams. Three 90-minute exams and a cumulative final exam will be given; see the weekly schedule for dates and coverage. Each exam will include a table containing all necessary constants, and a simple periodic table.

Final Exam. The final exam will be a 120-min, 70-item multiple choice exam provided by the American Chemical Society Examinations Institute. This covers the 2nd half of the text plus organic chemistry. The required review text is an excellent source of information and will help you practice and prepare for this exam, which should be no more difficult than the other exams during the semester. **The time (Tues, May 10, 8-10 PM) and place (201 Reichardt) of the final exam have been set by the UAF Registrar, not your professor. No early or late exams can be scheduled. If you miss the scheduled exam due to travel, then the University policy on Incomplete (I) grades will be invoked.**

Make-up exams will be allowed for good reasons, which you MUST DISCUSS with the professor. I slept in is not a good reason. (But: if you are late, or even *very* late, to the exam, make the effort to come in: we can accommodate you.) An unexplained absence from an exam results in a zero. If you anticipate an absence (intercollegiate sports, travel on military or University business), talk to your professor ***before*** the exam to make arrangements. If the absence is unexpected (illness, family or personal calamity, cold weather transportation difficulty), talk with the professor at the earliest possible opportunity. Come prepared to **document** your particular calamity. In any case, you must take the makeup exam within 1 week of your return to health. **If you are to take a makeup exam, we expect that you have no knowledge of the original exam**.

Ethical Considerations: As a UAF student, you are subject to the UA Honor Code, which says in part:

Students will not collaborate on any quizzes, in-class exams, or take-home exams that will contribute to their grade in a course, unless permission is granted by the instructor of the course. Only those materials permitted by the instructor may be used to assist in quizzes and examinations.

Students will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself (direct quotes or paraphrases) in compositions, theses, and other reports. No work submitted for one course may be submitted for credit in another course without the explicit approval of both instructors. Violations of the Honor Code will result in a failing grade for the assignment and, ordinarily, for the course in which the violation occurred. Moreover, violation of the Honor Code may result in suspension or expulsion.

Other banned activities: Using another student s clicker; copying answers on lab reports or exams.

The Chemistry Department Policy on Cheating is the following: Any student caught cheating will be assigned a course grade of F. The student s academic advisor will be notified of this failing grade and the student will not be allowed to drop the course.

During hour and final exams programmable and/or graphing calculators, cell phones, beepers, PDAs, and other electronic devices are NOT allowed on your person. Power-off any such item, and place it inside your closed briefcase, purse, or pack at the back of the room, or on the floor.

Grading

Item	Maximum Pts
Exam 1	100
Exam 2	100
Exam 3	100
Final Exam	100
OWL Homework	80
Clicker score	70
Lab	100
Total	**650**

Estimated Grade Scale (as % of 650 pts). (Subject to change):

%	Letter Grade
88-99%	A
77-88%	B
66-77%	C
55-66%	D
Less than 55%	F

Grades. Letter grades (A-F, no +/- grades) are assigned based on the total out of 650 points accrued in the semester. The approximate cut-offs for letter grades are shown above. These are *estimates only* based on prior semester results, and are subject to change up or down at the time final grades are assigned. The final cut-offs may differ from other C 106 sections because the exams, OWL and clicker questions are different.

Instructor-Initiated Withdrawals: Any time up to and including Friday, March 28, the professor has the right to withdraw a student from Chem 106X for any of the following reasons: (1) Exam I and II are missed without an excused absence, or (2) two or more labs are missed, or (3) the student shows poor class attendance, or (4) is missing a lot of OWL homework. This is our definition of ...has not participated substantially in the course. (See p. 44 in the Catalog.)

Disabilities: Students with physical or learning disabilities are required to identify themselves to Mary Matthews in the Disability Services office, located in the Center for Health and Counseling (474-7043). The student must provide documentation of the disability. Disability Services will then notify Prof. Keller of special arrangements for taking tests, working homework assignments, and doing lab work.

Incomplete (I) grade: A grade of I is assigned only when a student misses the final exam or multiple laboratory classes for a documentable reason, such as a medical problem, a death in the family, etc.

Important Dates: Please keep the following dates in mind.

Last day to drop class and get 100% refund ..... Friday, Jan. 28
Last day to drop class w 50% refund (course not on academic record) .....Friday, Feb. 4
Freshmen progress reports due.....Friday, Feb. 25
Last day for student- or instructor- withdrawal (W on academic record)..... Friday, Mar. 25
UAF SpringFest (no classes)..... Friday, April 29
Last of instruction: ..... Friday, May 6

Calculus I (MATH F200X) Spring 2011

Instructor: Dr. Leah Berman

Office: Chapman 303A

Office Phone: 907-474-7123

Cell Phone: 907-347-4021 (don't call after 9 PM)

e-mail: lwberman@alaska.edu (best way to contact me!)

AIM screen name: leahwrenn

Teaching Assistant: Kevin Joyce, ktjoyce@alaska.edu

Classroom and class meeting times:
11:45 am - 12:45 pm, MWF, Ernest Gruening Building 208
11:30 am - 12:30 pm , Th, Duckering Building 252

Recitation:

- Section F04: 2:00 pm - 3:00 pm, T, Duckering Building 352
- Section F05: 3:40 pm - 4:40 pm, T, Sydney Chapman Building 106
- Section F06: 5:20 pm - 6:20 pm, T, Ernest Gruening Building 208

Office hours: 10 – 11 MWF, 9:30 – 10:30 Th, and by appointment. To make an appointment, just drop me an e-mail. You are also welcome to stop by my office at any time and see if I am free (even without a scheduled appointment); however, there is a possibility that I may be busy/away if you haven't set up an appointment. These office hours are subject to change.

Prerequisites: A grade of C or better in MATH F107 (Functions for Calculus) and MATH F108 (Trigonometry), or appropriate placement test scores.

Course description, goals, student learning outcomes: This course is the first course in the calculus sequence. We will cover: limits and continuity, differentiation and tangent lines, applications of the derivative, integration, and applications of integration.

Goals: (1) to develop the theory of the derivative and integral; to develop an understanding of what these concepts are and what they mean, and how they are constructed. (2) To gain computational skill with these concepts. (3) To understand how and why to apply these concepts as tools to help solve a wide range of problems from other fields, including physics, biology, chemistry and business.

Required Text: *Calculus, Early Transcendentals*, 6th ed. by James Stewart, ISBN 10: 0-495-45829-5

Instructional methods:

Lecture: Class meets five times a week, there are four lecture hours and one recitation hour per week. The lecture will be primarily active lectures, supplemented with the occasional in-class worksheet. You are expected to participate in the lecture by asking questions! I will call on people at random during class.

Recitation: There is a recitation section once a week, led by our Teaching Assistant, Kevin Joyce. Attendance at the recitation section is mandatory. Quizzes and worksheets will be given during the recitation section. In addition, there will usually be time to ask questions.

Homework: Homework will be assigned on a regular basis; it will be posted on Blackboard, and you will be responsible for checking often. Homework assignments will not be announced in class.

Online Homework: You will be responsible for completing online homework exercises, similar to problems from your textbook, using a program called WebAssign. These problems are short answer and (except for true/false questions) you get multiple attempts with no penalty and

immediate feedback. They are graded right or wrong, no partial credit. This tool is great for practicing routine computational skills. These exercises will be due basically every day.

Class Keys for WebAssign:

- Section F04: uaf 6500 5653
- Section F05: uaf 4031 1377
- Section F06: uaf 3208 4585

Written Homework: There will be weekly written homework assignments, typically due on Wednesday. These are due at the end of class on the assigned date. No late homework assignments will be accepted.

You are encouraged to collaborate with your classmates on homework, but **you must indicate the names of the people with whom you collaborated.** All homework must be written up individually. You may find working on your homework in the Math Lab, Chapman 305, is useful; there you can get questions answered, free of charge.

Draconian homework writeup instructions: As with other classes where you are turning in written material, you are expected to turn in final drafts, not first drafts! Homework must be written *neatly and legibly*, **ideally in pen,** *with lots of white space*. Please write only on one side of the page. Leave plenty of white space so that your solution is easy to read. Your homework assignments *must be stapled*.

Proficiency tests: There will be two proficiency tests, one on limits and one on derivatives. These will initially be given during Recitation, **as announced**, after we have covered the appropriate sections. Each proficiency test is worth 5% of your grade! If you pass on the first try (you score $\geq 80\%$) you will receive that score. If you do not pass (you score $< 80\%$) on the first try, you may retake the test up to four more times, scheduled outside of class. When on one of these subsequent tries you score at least 80%, you will receive a score of 80% for the proficiency test. If you do not ever pass the proficiency test, then you may receive a score of 0 for that test.

Quizzes: There will be occasional 30 minute quizzes, administered during the Recitation section, as announced.

Exams: There will be three in-class exams. These are tentatively scheduled for Wednesday February 16, Wednesday, March 23, and Wednesday, April 20. There will be one final exam, scheduled for 10:15 a.m. – 12:15 p.m., Wednesday, May 11.

Tentative schedule: (subject to change)

Week beginning	Sections	Other info
(Jan 20)	1.1 – 1.2	
Jan 24	1.3 – 2.2	
Jan 31	2.2, 2.3, 2.5	Friday last day to add/drop
Feb 7	2.6 – 3.1	Limit prof. quiz probably this week
Feb 14	3.2 – 3.3	Exam 1 on Wednesday
Feb 21	3.4 – 3.6	
Feb 28	3.6 – 3.9	Deriv. prof. quiz probably this week
Mar 7	3.9 – 4.1	
Mar 14		Spring break (no class)
Mar 21	4.2 – 4.3	Exam 2 on Wednesday; Friday is last day to drop with W
Mar 28	4.4 – 4.7	
Apr 4	4.7 – 5.1	
Apr 11	5.1 – 5.3	
Apr 18	5.4 – 5.5	Exam 3 on Wednesday
Apr 25	6.1 – 6.2	SpringFest on Friday (no class)
May 2	6.3 – 6.5	
May 9		FINAL EXAM Wed. May 11

Course Policies:

e-mail: *You are responsible for checking your* alaska.edu *e-mail account every day before class.* This is the e-mail address I have access to, and this is what I will use to get in touch with you. If you don't typically check it, then set it up to forward to your main account.

Absences and make-ups: You are expected to attend every class. Missing classes will have an adverse effect on your course grade. *If you miss more than six classes, or if you do not show up to take an exam, I may withdraw you from the course.*

If you must miss class, you are responsible for notifying me ahead of time to make appropriate arrangements. Except in unusual circumstances, make-up quizzes and exams will not be given.

Illness: Please do not come to class if you are possibly contagious. If you are too sick to come to class, please e-mail me **BEFORE CLASS**. Except under extreme circumstances, if you do not e-mail me before class I may not be able to arrange for make-up quizzes, etc.

Announcements: From time to time, announcements and comments will be sent out via e-mail. **It is your responsibility to check your e-mail account to receive this information.**

Evaluation:

Online Homework	10%
Quizzes, Written Homework, and other graded material	15%
Limit Proficiency Test	5%
Derivative Proficiency Test	5%
Exam 1	15%
Exam 2	15%
Exam 3	15%
Final exam	20%

To get a rough sense of how numerical grades correspond to letter grades, in general, 94% is the lower bound for an A and 55% is the lower bound for a D-, with linear interpolation in between, so that a numeric grade may be calculated by putting a percentage into the function $gr(x) = 23/8 + (5/57)(x - 93)$. This implies that the lower bound for an A- is 89.2%, the lower bound for a B- is 77.8%, etc. However, I reserve the right to change this scheme slightly depending on the particulars of the exam (e.g., how easy/hard it was). Also, your final grade will be calculated by summing all your numerical (not letter) grades, weighted as shown above. If you have any questions or concerns, come talk to me!

Support Services: You are strongly encouraged to attend office hours if you have questions, or e-mail/instant message me. I also encourage you to work with other students where appropriate. You may find the Math Lab (Chapman 305) to be helpful as well. Our teaching assistant also has hours in the Math Lab; check the posted schedules.

Disabilities Services: The Office of Disability Services implements the Americans with Disabilities Act (ADA) and insures that UAF students have equal access to the campus and course materials. I will work with the Office of Disability Services (203 WHIT, 474-7043) to provide reasonable accomodation to students with disabilities. Please come talk to me as soon as possible if you have/need accomodations.

MATH 201X: Calculus II SPRING 2011
Syllabus

Instructor: Gordon Williams
Contact Details: Chapman 303B, giwilliams@alaska.edu, 455-2756
Office Hours: MW 2:15-3, T 12:30-2, F 2:15-3:15, and by appointment. To make an appointment, just drop me an e-mail. You are also welcome to stop by my office at any time and see if I am free (even without a scheduled appointment); however, there is a possibility that I may be busy/*away* if you haven't set up an appointment. These office hours are subject to change.
Lecture Hours: MWF 1-2 PM DUCK 252, T 2-3 PM CRUE 206
Textbook: *Calculus II*, James Stewart (custom edition) ISBN 10: 0-495-45830-9 **OR** *Calculus*, James Stewart, 6th edition, early transcendentals
Course Web Page: `http://sites.google.com/a/alaska.edu/gordon-williams/home/20182011`
Prerequisites: a grade of C or better in Math 200 Calculus I or its equivalent

---

Course Overview and Goals:

The course description in the catalog reads as follows:

> Techniques and applications of integration. Integration of trigonometric functions, volumes including those using slicing, arc-length, integration by parts, trigonometric substitutions, partial fractions, hyperbolic functions, and improper integrals. Numeric integration including Simpson's rule, first order differential equations with applications to population dynamics and rates of decay, sequences, series, tests for convergence including comparison and alternating series tests, conditional convergence, power series, Taylor series, polar coordinates including tangent lines and areas, and conic sections.

Here's how I think of the course.
A. We continue where Calculus I left off...integration. We will learn several very sophisticated new methods of integration and we will see some new applications. You will be a good integration machine when we're done!
B. Next we will skip to Chapter 11 on Sequences and Series. This will be a completely new topic for most students and an incredibly interesting and surprising one. There are many ways this material relates to earlier ideas and here's one. Even after we're done with Chapter 8: Techniques of Integration, there will be many lovely, continuous, simple functions we still cannot integrate. The ideas in Chapter 11 will give us a powerful technique for attacking these.
C. We will end with a couple of new methods of representing curves: parametric curves and polar coordinates. In addition to enlarging our repertoire of curves, it is a foreshadowing of some crucial ideas in Calculus III.

Course Mechanics:

Class meetings will be run as an interactive lecture as much as is possible. I will always begin by asking if there are any questions – about homework or topics recently covered in class— and you

can help things go quickly by writing your questions on the board as we come in to class. Also, I will ask lots of questions of you and encourage you to participate. We will work problems in class too. Lectures will be supplemented with the occasional in-class worksheet or lab activity. You are expected to participate in the lecture by asking questions! I will call on people at random during class.

Attendance is expected and strongly encouraged, but not required. I will take roll regularly.

Online homework will be assigned multiple times each week using the online tool Web Assign. (See instructions on course web site for details.) These assignments will cover the essential practice exercises necessary to make progress in Calculus (approximately 10-15 routine problems per section). All deadlines are final. Your online homework average will be calculated as (points earned)/(points possible).

Textbook homework problems will be assigned regularly. These will be due on a weekly basis and will typically consist of two to three more challenging problems from each section. These problems are especially good practice for learning how to write up a solution to a problem, and a selection of these problems will be graded for both style and correctness (frequently, all of them). Late written homework will not be accepted.

Quizzes will be given intermittently as a check of basic skills. Quizzes will be announced in advance, typically take 20-30 minutes of class time, and grading will emphasize your ability to demonstrate clearly that your answer is the correct one. Make-up quizzes will only be given for excused absences at the instructors discretion. Calculators will not typically be allowed.

For quizzes and written homework the grade bands will be lowered by a letter grade: A (80-100%), B (70-80%), C (60-70%), D (50-60%), F (below 50%).

Exams will be written without the use of calculators. There will be two midterms and a comprehensive final exam. The midterms are tentatively scheduled for Monday February 21st and Monday April 4th. **The Final Exam will be Wednesday 11th May 1–3 PM.** It is DMS policy that final exams cannot be given early or late.

Make-up Midterms will be given only for excused absences. Except in extreme emergencies, absences *must* be approved in advance.

Grades will be calculated according to the following rubric:

Written homework / quiz average	10%
Online homework average	10%
Midterm 1	25%
Midterm 2	25%
Final Exam	30%

Grade Bands: A, A- (90 - 100%), B+, B, B- (80 - 89%), C+, C, C- (70 - 79%), D+, D, D- (60 - 69%), F (0 - 59%). I reserve the right to lower the thresholds. Also, in an effort to reward the student who makes significant improvement over the course of the term, a stellar grade on the final may overcome a deficiency on the midterm and improve a student's final grade.

(TENTATIVE) SCHEDULE OF TOPICS:

dates	topics	dates	topics
Week 1	intro, 7.1	Week 10	11.5, 11.6, 11.7
Week 2	7.1, 7.2	Week 11	11.7, 11.8, Review
Week 3	7.3, 7.4	Week 12	Midterm 2, 11.9, 11.10
Week 4	7.5, 7.7, 7.8	Week 13	11.10, 11.11, 10.1
Week 5	7.8, 8.1, 8.2, Review	Week 14	10.1, 10.2, Thanksgiving
Week 6	Midterm 1, 8.3, 11.1	Week 15	10.3, 10.4
Week 7	11.1, 11.2, 11.3	Week 16	10.5, 10.6, Review
Week 8	11.3, 11.4, 11.5	Week 17	Review, Final Exam

MISCELLANEOUS OTHER ISSUES:

Tutoring is available at no extra cost, on a walk-in basis, at the Math Lab in Chapman 305. Hours will be announced and posted on the door. A good way to use the Math Lab is to simply go there to do your homework, so that if any questions arise you can get immediate help.

Course accommodations: If you need course adaptations or accommodations because of a disability, please inform your instructor during the first week of the semester, after consulting with the Office of Disability Services, 203 Whitaker (474-7403).

University and Department Policies: Your work in this course is governed by the UAF Honor Code. The Department of Mathematics and Statistics has specific policies on incomplete grades, late withdrawals, and early final exams, some of which are listed below. A complete listing can be found at http://www.dms.uaf.edu/dms/Policies.html.

Late Withdrawal: This semester the last day for withdrawing with a W appearing on your transcript is Friday, March 25th. If, in my opinion, a student is not participating adequately in the class, I may elect to drop or withdraw this student. Inadequate participation includes but is not limited to: missing an exam, repeatedly failing to take quizzes or complete homework assignments, or having a failing average (below 70%) at the withdrawal date.

Academic Honesty: Academic honesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.

Courtesies: As a courtesy to your instructor and fellow students, please arrive to class on time, turn your cell phones and iPods off during class, and pay attention in class.

MATH 202: Calculus III

MTWF 8:00 – 9:00

Grossing 208

http://www.cas.usf.edu/~eallman/classes/202-fall-2009/202-2009.html

Instructor: Elizabeth S. Allman

Contact Details: Chapman 308B, e.allman@usf.edu and 474-2479.

Office Hours: T 9-10, W 10:15-11:15, F 10:15-11:15 and by appointment.

Prerequisites: Calc II with a grade of C or better. No exceptions will be made.

Textbook: *Calculus* (early transcendentals), 5th ed., by J. Stewart, Brooks/Cole

Midterms: (tentative) W October 7, W November 18

Final Exam: Friday, December 18, 8:00 – 10:00 am

Course Overview and Goals:

Multivariable calculus is concerned with functions of many variables. Whereas in MATH 200 and MATH 201 you study functions of a single variable (height as a function of age $h(a)$, $f(x)$), in multivariable calculus functions will have more input variables (temperature of a particle in 3-space) or be vector-valued functions (position in 3 space $(x(t), y(t), z(t))$).

Our goal this semester is to extend your knowledge of calculus into the 2-, 3-, and n-dimensional realms. All of the techniques you learned from single variable calculus come into play here. Indeed, taking derivatives and computing integrals in the multivariate setting depends intimately on the ability to apply skills from univariate calculus.

Other interesting topics like vector fields and alternative coordinate systems appear. Multivariate calculus is essential for further study in physics, chemistry, engineering, economics, and many other fields, as well as in mathematics. Though visualization in three dimensions can be hard at first, the benefit is well-worth the effort.

Course Mechanics:

Class meetings will be run as interactive lectures, to the extent possible given the curriculum. That means that while I will be presenting material at the board, and you will be taking notes, I will also be asking for suggestions, ideas, and questions about the material as we go along. I don't expect 'correct' answers, but I do expect you to be actively following and participating (and taking notes) — that makes the class more interesting for us all.

Class attendance is expected, although I will not formally take roll. If you miss a class, you should get notes from another student. Homework assignments will be posted on the course web page either right before class or soon after class is over. You should bookmark the homework web page, as this is where you will find assignments, due dates, and updates.

Quizzes will be given randomly throughout the semester, roughly once per week. These will typically take 10-15 minutes and be similar to recent homework. These serve two primary purposes 1) to encourage you to be present in every class and 2) to ensure that you stay current with the homework. If you expect to miss a class, you should talk to me in advance about having any potential quiz waived — you must have a good reason one (except in situations I consider to be emergencies) you cannot get retroactive approval.

Homework will usually be assigned daily, and collected each Wednesday. I will typically begin each class by asding if there are questions about the last lecture and its homework

assignment. That means you should review notes and make at least an initial attempt on homework problems before the next class meeting, even though problems may not be collected until several days later. While it never hurts to ask, in general I will defer questions about any earlier assignment to my office hours, in order to keep the course moving along.

I encourage you to work with others on the homework, but you must *write up solutions independently*. You will learn nothing from simply copying someone's solution. Even though you may find you can't do every problem, you must make a reasonable attempt on them all. The entire homework assignment will be checked to be sure you have attempted everything. Selected problems may be graded more completely, if a grader is assigned to this course.

Homework will be accepted until 5pm on its due date, either at my office or in my mailbox in the math department office. I will not accept any late homework that has not been cleared ahead of time or is not due to a genuine emergency (e.g., a death in the family).

Missed examinations that are not approved in advance will result in an 'F' on that exam. No make-up exams will be given except in extreme circumstances (e.g., family death, documented illness, etc.). Notifying me by email or a note that you will miss an exam is not sufficient for advance approval; you must speak with me to be excused.

Tutoring is available at no cost, on a walk-in basis, at the Math Lab in Chapman 305. Hours will be announced, and posted on the door. A good way to use the Math Lab is to simply go there to do your homework, so that if any questions come up you can get immediate help.

Calculators will not be allowed on any examinations or quizzes. This will ensure that testing conditions are equal for everyone. I have no strong feelings on whether you use a calculator when doing homework. As long as you are sure you have the skills to do all calculations by hand, it is fine for you to use technology as a time saver.

Auditing of this course will only be allowed for those who agree to attend regularly, as evidenced by completion of midterm exams and most quizzes.

Grades:

There will be two midterm exams and a cumulative final exam in MATH 202. In addition, there will be weekly homework assignments and regular (announced and unannounced) quizzes. Grades will be assigned using the following weights:

Homework	10 %
Quizzes	15 %
Midterm 1	20 %
Midterm 2	25 %
Final Exam	30 %

Grade Bands: A, A- (90 - 100%); B+, B, B- (80 - 89%); C+, C, C- (70 - 79%); D+, D, D- (60 - 69%); 69 (0 - 59%). On rare occasion, I may lower the thresholds. Also, in an effort to reward the student who makes significant improvement over the course of the term, a stellar grade on the final may overcome a deficiency on the midterm and improve a student's final grade.

University and Department Policies:

Course accommodations: If you need course adaptations or accommodations because of a disability, please inform your instructor during the first week of the semester, after consulting with the Office of Disability Services, 203 Waltaker (474-7403).

Detailed Policies: Your work in this course is governed by the UAF Honor Code. The Department of Mathematics and Statistics has specific policies on incompletes, late withdrawals, and early final exams, some of which are listed below. A complete listing can be found at

`http://www.dms.uaf.edu/dms/Policies.html`

Prerequisites: The prerequisite for MATH 202 is MATH 201 with a grade of C or better. Students not meeting this prerequisite are not eligible to take this course and will be dropped.

Late Withdrawal: This semester the last day for withdrawing with a 'W' appearing on your transcript is October 30.

Graded Coursework: Please keep all graded work for MATH 202 until final grades have been assigned.

Academic Honesty: Academic dishonesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.

Courtesies: As a courtesy to your instructor and fellow students, please arrive to class on time and turn your cell phones and iPods off during class.

Math 302 Differential Equations Spring 2011

3 Credits

Class time: **Tue, Thu 9:45 - 11:15, GRUE 205**

Instructor: Dr. Alexei Rybkin, CHAP 304B, 474-6002, e-mail: arybkin@alaska.edu

Office Hours: MWF 10:30 - 11:30, and by appointment; CHAP 304B

Prerequisites: MATH 200-202 with a C or better.

Text: Differential Equations by G. Zill, classic fifth edition.

Course Description:

Galileo Galilei once said 'Mother Nature speaks the language of differential equations'. It was said three hundred years ago and it becomes even truer nowadays. This course is a foundation for many physics and engineering courses. It will also put your calculus together. The main goal of this course is to equip you with active knowledge of basic methods for solving ordinary differential equations. This course shall cover parts of Chapter 1. (Introduction to Differential Equations), 2. (First-Order Differential Equations), 3. (Applications of First-Order Differential Equations), 4. (Linear Differential Equations of Higher Order), 5. (Applications of Second-Order Differential Equations: Vibrational Models), 6. (Differential Equations with Variable Coefficients) if time permits, 7. (Laplace Transform)

Homework and Quizzes:

Homework (hw) will be assigned every class period and due **Thursday in the beginning of the class period.** Specific requirements on hw submission will be given later if need arises. Expect also to have **quizzes** announced one day in advance. One quiz will weight as one hw assignment. Exact number of quizzes is not set up yet. Absolutely **no late hw** will be accepted and **no make-ups** for quizzes will be offered. However about **15%** of lowest grades will be dropped. Hw and quizzes will be graded by the TA. Only a sample of hw problems will be graded. I will grade the tests.

Midterms:

There will be **three** one-hour **closed book midterms** (announced at least one week in advance). No graphing calculator is allowed. An hour review will be given one

class prior to each midterm discussing the exam in great detail. No make-ups except for documented circumstances.

Final Exam:

A two hour closed book comprehensive exam is on **Tue, May 10, 3:15 -5:15.** Please do not plan on leaving prior to the final exam as it is against the departmental policy to give earlier final exams (see http://www.dms.uaf.edu/dms/Policies.html)

Attendance: Will not be taken. If you are late or miss class you should get notes/important info from a **fellow student**.

Support Service: Math Lab in Chap 305 is available for free with tutors on duty.

Grades: Are determined from:

- Hw and Quizzes **20%**
- Three Midterms **50%**
- Final **30%**

Course grades are determined as follows (in interval notation):

A+	(97,100]	B+	(87, 90)	C+	(77, 80)
A	(93, 97]	B	(83, 87]	C	(73, 77]
A-	[90, 93]	B-	[80, 83]	C-	[70, 73]
D+	(67, 70)	F	[0, 60)		
D	(63, 67]				
D-	[60, 63]				

I reserve the right to adjust this scale if particular exams turn out to be unexpectedly difficult. This however happens very rarely and you should not rely on this. Borderline cases will be graded up or down based upon your overall performance (including attendance and class room participation).

Withdrawals:

The deadline for withdrawal is **March, 25.** I reserve the right to withdraw you from class if you are subject to one of:

- fail to submit **two** or more consecutive hw assignments
- maintain an average of **55%** or less on quizzes and tests by the withdrawal deadline
- don't have all **prerequisites** for this class

EXTRACTED FROM HTML FORMART CONVERTED TO WORD

Physics 211

General Physics
Fall 2010

Instructor: David Newman
Office: 112 NSCI
Office Phone: 474-7858
Home Phone: 458-8576 (if all else fails!! But please not after 11 PM)
Email: denewman@alaska.edu

Office Hours:

Monday 3:30-5:30pm in 112 NSCI

Wednesday 11:30-1:30pm in 112 NSCI

Additionally, a help room will be staffed to answer homework related questions. This will be in the Physics conference room (122NSF) and will be staffed at various times each day (the schedule is posted on the Rm122 door).

Semester schedule (calendar)

Homework

Review/Problem Sessions

Final Exam Formula sheet (PDF format)

Web Projects (they are coming...don't give up)

Links to Web info (to help with your project)

Link to Auroral Forecast at the GI

Grades **not yet available due to missing information (ie they are coming)**

This syllabus is located at: http://ffden-2.phys.uaf.edu/211_fall_2010.html

Course Syllabus

In approaching this (and all) classes, please note the following ancient chinese proverb:

Teachers can open the door,
but you must enter by yourself.

Course Content: In the first part of the course you will learn the basic language of physics including measurement and how we discuss and quantify motion. We will then move on to calculating the motion of bodies which will lead us into the wonder of Newton's 3 laws of motion. You will learn to love them (or at least learn them) and their applications to such a wide range of problems such as fair rides, space ships, skidding cars and even hanging signs. Then the course will explore energy and momentum, two of the most important and powerful concepts in the physics of motion. This will be followed by an introduction into Gravitation followed by fluid mechanics. This will then lead into a discussion of waves including sound wave and such cool things as noise canceling headphones. Most importantly, you will learn to impress your friends and relatives with your knowledge of the universe (or bore them to tears), so be prepared for being introduced to "*The Power of Physics*".

Prerequisites: Calculus and high school physics. Algebra, trigonometry and calculus will be used extensively.

Materials Needed:

Required Text:	*University Physics*, Bauer and Westfall
Calculators:	No calculators may be used during exams or quizzes. Otherwise, buy yourself a nice one. A basic, simple scientific calculator with trigonometric, exponential, and logarithmic functions is all that you need.

Lectures: 10:30am MWF in 201A NSCI. *The lectures supplement but do not substitute for the reading.* Lectures will cover the major topics, emphasizing and discussing the important points. They are not sessions to regurgitate material already written in the text. Your personal participation is important, and it is critical that you read the assigned material before lecture. Time permitting, several Friday lectures will cover special topics beyond the scope of the text. These will be announced before hand.

Homework: There will be approximately one homework assignment per week. The assignment will be given out (and posted on the web and in the hall in front of my office) on Wednesdays and will be due in on the following Thursday by 5:00PM. Place your homework in the appropriate box in the Physics Department Office. You are encouraged to work with others on the homework, but make sure the paper you turn in is not simply copied from someone else.

These assignments help me assess your understanding of the material, and will count toward your final grade.
Late problem sets will not be accepted.
Only a selection of problems will be graded each week, totaling about 25-30 points each.

Quizzes: 6 short quizzes will be given in class during the semester. They will be closed book and no calculators allowed (or needed). All difficult formulas needed will be given and the quiz will be similar to some of the recent homework or topics covered in class. The quizzes will be announced in class and on the schedule page at least one week in advance.

Project: There will be a project due worth a maximum of approximately 10% of the course grade. The project will be in the form of a web page on a topic in physics that you find interesting and we agree on together. These topics could include biographies of important scientists, scientific projects and scientific ideas. The topic must be agreed to by Oct 6th and must be competed by Nov 24th. They will be graded both for presentation and content. More details will be discussed in class and on the web project link above.

Labs: There is a lab associated with this course. **ALL** labs and reports must be completed to get a passing grade for the lab.
A PASSING GRADE IN THE LAB IS NECESSARY TO PASS THE COURSE.
Labs may only be made up if excused and with permission of the course instructor. Questions about the lab should be directed to the teaching assistant in charge of your lab or as a last resort me.

Hour Exams: Exams will be given during the Friday(or monday) lecture as follows:

```
        Oct. 8, approx. Chapters 1-5
        Nov 12, approx. Chapters 6-11
The exams will be closed-book, but you will be given one side of
an 8 1/2 x 11-inch sheet with most of the needed equations. No
calculators are allowed. The exams will be graded and handed back as
soon as possible. Solutions will be discussed.
```

Final Exam: The final exam will be at 10:15 a.m. - 12:15 p.m., Friday, Dec. 17. It will cover the entire course (Chapters 1-16), with some emphasis on the more recent material. The final will be closed-book, but you will be given two sides of an 8 1/2 x 11-inch sheet with most of the needed equations.

Grading: The course grade will consist of the following components (though I reserve the right to make grade adjustments based on performance trends):

2 hour exams	30 %
Final exam	25 %
Homework	10 %
Quizzes	10 %
Project	10 %
Lab	15 %

I grade on a curve however to satisfy university requirments, above 95% will be at least an A, above 85% will be at least a B above 75% will be at least a C, above 65% will be at least a D (in most cases the actual curve is significently lower!).

Contacting Me: I have office hours as listed above. You can drop by at other times if I'm not busy, or make an appointment. I am (almost) *never* available before class.

Special Needs: The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. We will work with the Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accommodation to students with disabilities.

Plagiarism etc: Plagiarism and cheating are matters of serious concern for students and academic institutions. This is true in this class as well. The UAF Honor Code (or Student Code of Conduct) defines academic standards expected at the University of Alaska Fairbanks which will be followed in this class. (Taken from the UAF plagiarism web site, which has many links with good information about this topic)

Complaints and Concerns: You are always welcome to talk to me about anything, however, if you have a non-subject matter question or concern that cannot be resolved by me, contact the department chair, Dr. Chowdury, Physics Department Office, room 102 NSCI.

Alternate References: To see the same topics explained differently, try the following:

Physics for Scientists and Engineers, Serway and Jewett.

Fundementals of Physics, 8th edition, Halliday Renick and Walker.
The Feynman Lectures on Physics, Richard Feynman (a great set of books...but rather deep)

Here is a good web site on how to study physics which might be of interest and use: How to study physics

General Advice: Physics is not something you read and memorize, rather it is something you learn how to do. Try the following study procedure:

1. Read the chapter prior to lecture, so that you will know what it's about.
2. Listen carefully to the lecture and take notes.
3. This is crucial: *Do not go back and read and re-read* the chapter until you "understand it." Rather, start working problems, going back through the chapter to clarify points as they come up. I suggest you try to answer all "Checkpoint" problems in the text and the questions at the end of the chapter. If you understand these, you've probably understood the salient points of the chapter.
4. Think! Don't simply try to fit the problems into the form of another problem, think through the problem first.
5. **Interesting Physics computer demos**

EXTRACTION FROM HTML FORMAT TO CONVERT TO

Physics 212

General Physics
Fall 2009

Instructor: David Newman
Office: 112 NSCI
Office Phone: 474-7858
Home Phone: 458-8576 (if all else fails!! But please not after 11 PM)
Email: ffden@uaf.edu

Office Hours:

Monday 3:30-5:00pm in 112 NSCI

Wednesday 11:30-1:30pm in 112 NSCI

Additionally, a help room will be staffed to answer homework related questions. This will be in the Physics conference room (122NSF) and will be staffed at various times each day (the schedule is posted on the Rm122 door).

Semester schedule (calendar)

Homework

Review/Problem Sessions

Formula sheets Final Exam(PDF format)

Web Projects

Links to Web info (to help with your project)

Link to Auroral Forecast at the GI

Grades not yet available due to missing information (ie your work)

This syllabus is located at: http://ffden-2.phys.uaf.edu/212_fall_2009.html

Course Syllabus

Course Content: In the first part of the course you will learn basic thermodynamics including the 3 laws of thermodynamics and applications to such diverse problems as temperature, the efficiency of engines and the ultimate fate of the universe. Then the course will explore electricity and magnetism. We will start by discussing electrostatics followed by DC circuits and magnetostatics. Then we will talk about the interactions between electric fields and magnetic fields which will lead to AC circuits. We will then end the semester with an introduction to Electromagnetic waves. Most importantly, you are also very likely to learn to impress your friends with your knowledge of the universe (or bore them to tears), so be prepared for being introduced to "*The Power of Physics*".

Prerequisites: Calculus, high school physics and Physics 211. Algebra, trigonometry and calculus will be used extensively.

Materials Needed:

Required Text:	*Fundementals of Physics*, 8th edition, Halliday Renick and Walker.
Calculators:	No calculators may be used during exams or quizzes. Otherwise, buy yourself a nice one. A basic, simple scientific calculator with trigonometric, exponential, and logarithmic functions is all that you need.

Lectures: 5:50pm MWF in 201A NSCI. *The lectures supplement but do not substitute for the reading.* Lectures will cover the major topics, emphasizing and discussing the important points. They are not sessions to regurgitate material already written in the text. Your personal participation is important, and it is critical that you read the assigned material before lecture. Time permitting, several Friday lectures will cover special topics beyond the scope of the text. These will be announced before hand.

Homework: There will be approximately one homework assignment per week. The assignment will be given out (and posted on the web and in the hall in front of my office) on Wednesdays and will be due in on the following Thursday by 5:00PM. Place your homework in the appropriate box in the Physics Department Office. You are encouraged to work with others on the homework, but make sure the paper you turn in is not simply copied from someone else. These assignments help me assess your understanding of the material, and will count toward your final grade.
Late problem sets will not be accepted.
Only a selection of problems will be graded each week, totaling about 25-30 points each.

Quizzes: 6 short quizzes will be given in class during the semester. They will be closed book and no calculators allowed (or needed). All difficult formulas needed will be given and the quiz will be similar to some of the recent homework or topics covered in class. The quizzes will be announced in class and on the schedule page at least one week in advance.

Project: There will be a project due worth a maximum of approximately 10% of the course grade. The project will be in the form of a web page on a topic in physics that you find interesting and we agree on together. These topics could include biographies of important scientists, scientific projects and scientific ideas. The topic must be agreed to by Oct 6th and must be competed by Nov 25st. They will be graded both for presentation and content. More details will be discussed in class and on the web project link above.

Labs: There is a lab associated with this course. **ALL** labs and reports must be completed to get a passing grade for the lab.
A PASSING GRADE IN THE LAB IS NECESSARY TO PASS THE COURSE.
Labs may only be made up if excused and with permission of the course instructor. Questions about the lab should be directed to the teaching assistant in charge of your lab or as a last resort me.

Hour Exams: Exams will be given during the Friday(or monday) lecture as follows:

```
Oct. 9, approx. Chapters 18-22
Nov 13, approx. Chapters 23-28
```

The exams will be closed-book, but you will be given one side of an 8 1/2 x 11-inch sheet with most of the needed equations. No calculators are allowed. The exams will be graded and handed back as soon as possible. Solutions will be discussed.

Final Exam: The final exam will be at 5:45-7:45 pm on Fri, Dec 18. It will cover the entire course (Chapters 18-33), with some emphasis on the more recent material. The final will be closed-book, but you will be given two sides of an 8 1/2 x 11-inch sheet with most of the needed equations.

Grading: The course grade will consist of the following components (though I reserve the right to make grade adjustments based on performance trends):

2 hour exams	30 %
Final exam	25 %
Homework	10 %
Quizzes	10 %
Project	10 %
Lab	15 %

I grade on a curve however to satisfy university requirments, above 95% will be at least an A, above 85% will be at least a B above 75% will be at least a C, above 65% will be at least a D (in most cases the actual curve is significently lower!).

Contacting Me: I have office hours as listed above. You can drop by at other times if I'm not busy, or make an appointment. I am (almost) *never* available before class.

Special Needs: The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials.

We will work with the Office of Disabilities Services (203 WHIT, 474-5655) to provide reasonable accommodation to students with disabilities.

Plagiarism etc: Plagiarism and cheating are matters of serious concern for students and academic institutions. This is true in this class as well. The UAF Honor Code (or Student Code of Conduct) defines academic standards expected at the University of Alaska Fairbanks which will be followed in this class. (Taken from the UAF plagiarism web site, which has many links with good information about this topic)

Complaints and Concerns: You are always welcome to talk to me about anything, however, if you have a non-subject matter question or concern that cannot be resolved by me contact the department chair, Dr. Olson, Physics Department Office, room 102 NSCI.

Alternate References: To see the same topics explained differently, try the following:

Fundamentals of Physics, 5th or 6th edition, Halliday, Resnick, Walker (similar to Serway)
The Feynman Lectures on Physics, Richard Feynman (a great set of books...but rather deep)

Here is a good web site on how to study physics which might be of interest and use: How to study physics

General Advice: Physics is not something you read and memorize, rather it is something you learn how to do. Try the following study procedure:

1. Read the chapter prior to lecture, so that you will know what it's about.
2. Listen carefully to the lecture and take notes.
3. This is crucial: *Do not go back and read and re-read* the chapter until you "understand it." Rather, start working problems, going back through the chapter to clarify points as they come up. I suggest you try to answer all "Checkpoint" problems in the text and the questions at the end of the chapter. If you understand these, you've probably understood the salient points of the chapter.
4. Think! Don't simply try to fit the problems into the form of another problem, think through the problem first.
5. **Interesting Physics computer demos**

Appendix B – Faculty Vitae

1. Cheng-fu Chen

2. Education

- 1988 B.S. Mechanical Engineering, National Taiwan University, Taiwan
- 1990 M.S. Mechanical Engineering, National Taiwan University, Taiwan
- 2000 Ph.D. University of Wisconsin, Madison

3. Academic Experience

- Associate professor, (2009-present)
- assistant professor (2002-2009)

4. Non-academic experience

- Postdoc fellow, University of Wisconsin, Madison (2000-2002)

5. Professional registrations

6. Membership

- ASEE
- IEEE

7. Honors and awards

- Air Force Summer Faculty Fellowship, 2009

8. Service activities

- Coordinator of MS and BS/MS programs, Board member of Midnight Sun Swim Team, committee chair and member of graduate students, faculty mentor, journal referee.

9. Publications (2008-2011)

Refereed Journal Papers (students names are underlined)

1. C.-f. Chen and D. Peterson, "Stress buildup of Sn3.5Ag soldered stacked CSPs to board-level drop impact," *IEEE Trans. Components Packaging and Manufacturing Technologies*, 1(3), pp. 344-351, 2011.
2. C.-f. Chen and P. C. Karulkar, "Dependence of flip chip solder reliability on filler settling," *IEEE Trans. Advanced Packaging*, 32, 3, pp.1-9, 2009.
3. C.-f. Chen and K. L. Drew, "Droplet-based microdialysis –concept, theory, and design consideration," *J. Chromatogr. A.*, 1209:1-2, pp. 29-36, 2008.
4. C.-f. Chen, "Effect of underfill filler settling on thermomechanical fatigue analysis of flip-chip eutectic solders," *Microelectronics Reliability*, 48, pp. 1040-1051, 2008.
5. C.-f. Chen and P. C. Karulkar, "Underfill filler settling effect on the die backside interfacial stresses of flip chip packages," *ASME J. Electron. Packag.*, 130 (3), pp. 031005-1-10, 2008.

10. Professional development activities

- ASEE Air Force Research Laboratory Summer Faculty Fellow, 2009. This fellowship allowed me to conduct on-site research of prototyping microfluidic devices for droplet emulsion for droplet-based microdialysis.
- NASA Alaska EPSCoR Travel Award (2009) and Technical Workshop Travel Award (2010). Both help embarking on collaboration with NASA on the topics of microfluidics and stacked chip scale packaging.
- Reviewed papers for the journals IEEE Industrial Electronics Society, Microelectronic Reliability, IEEE Adv. Packaging, IEEE Compon. Packaging Technol., and Annals of Biomedical Engineering.
- Cheng-fu Chen, Kelly L. Drew, Digital microdialysis by operating droplets in a miniaturized probe, Provisional patent pending, United States Patent Office, July 20, 2006. Application number 60/831,924

1. Debendra K. Das

2. Education

- B.S. (with honors) Mechanical Engineering, Regional Engineering College (Presently National Institute of Technology) Rourkela, Valedictorian, Sambalpur University, India, 1972.
- M.S. Mechanical Engineering, Brown University, Rhode Island, 1974.
- Ph.D. Mechanical Engineering, University of Rhode Island, 1983.

3. Academic Experience

- 1997-1998 & 2006-2007 Chair, Dept. of Mechanical Engineering, University of Alaska
- 1993-present Professor of Mechanical Engineering, University of Alaska
- 1988-1993 Associate Professor of Mechanical Engineering, University of Alaska.
- 1984-1988 Assistant Professor of Mechanical Engineering, University of Alaska.
- 1980-1983 Instructor (half-time), University of Rhode Island, Kingston, RI.
- 1978-1980 Teaching Assistant, University of Rhode Island, Kingston, RI.
- 1972-1974 Research Assistant, Brown University, Providence, RI.

4. Non-academic Experience

- 1983-1984 Research Engineer, Naval Surface Weapons Center, Dahlgren, VA.
- 1979-1983 Mech. Eng. Staff Consult. (half-time); BIF, A Unit of General Signal, RI.
- 1974-1978 Mechanical Engineer, Tower Iron Works, Inc., Seekonk, MA.

5. Certifications or professional registrations

- Certified teacher of Family to Family Class, National Alliance on Mental Illness
- Registered Professional Engineer in Rhode Island (1978-1988) and Alaska (1987-
- present)

6. Current Membership in Professional Organizations

- American Society of Mechanical engineers
- Tau Beta Pi Honor Society
- American Association of University Professors

7. Honors and Awards

- Recipient of the best graduate gold medal (valedictorian) in 1972 for graduating with highest percentage of marks among five branches of engineering (civil, electrical, mechanical, metallurgical and chemical) offered at two campuses of the Sambalpur University System, with an annual graduation of about 500 students.
- Recipient of 1990 Univ. of Alaska Fairbanks School of Engineering Merit Award.
- The Institution of Engineers (India) Orissa State Center's best paper prize in January 1992 for the paper entitled "An Experimental Study of Flow Measurements Using a Laser Doppler Velocimeter."
- Recipient of 1996 Professor of the Year Award from ASME Student Section of Univ. of Alaska Fairbanks.
- Recipient of Engineer of the Year Award: 2000 & 2008 from the ASME, AK Section.
- Elected a Fellow of the American Society of Mechanical Engineers in February 2004.
- Recipient of Dr. Carol Feist Outstanding Advisor Award for 2003-04 & 2005-06 at University of Alaska.
- ASME Student Section Advisor Award for Region VIII, 2005
- ASME Student Section Advisor Award among all Districts of ASME Internatio., 2006

- Recipient of Distinguished Service Award from NAMI Alaska for the year 2007
- Recipient of Dedicated Service Award from ASME International for the year 2007

8. Service Activities

- ASME Executive board member Dist D, 2006-to date
- Past ASME Student Section Committee Senior Rep to national form Dist D
- Past Chair, ASME Northern Alaska Subsection
- Reviewer of articles for journals and proposals
- Chair, Engineering PhD Program Review Committee, AY07-08
- Mechanical Engineering Department Chair, August 2006-August 2007

9. Important Publications:

Books

Vajjha, R.S. and Das, D. K., Measurements of Nanofluids Properties and Heat Transfer Computation, LAP Lambert Academic Publishing, 2010, ISBN: 978-3-8383-7214-3, 114 pp.

Strandberg, R.T. and Das, D. K., Heat Transfer Performance of Nanofluids, Applications in Facility Heating, LAP Lambert Academic Publishing, 2010, ISBN:978-3-8383-9842-6, 136 pp.

Journals and Refereed Proceedings

Konakanchi, H., Vajjha, R.S., Misra, D. and Das, D.K., "Electrical Conductivity Measurements of Nanofluids and Development of New Correlations", accepted for Publication in Journal of Nanoscience and Nanotechnology, January 2011.

Das, D., Vajjha, R., Strandberg, R and Kulkarni, D., 2010, "Enhancement of the Performance of Thermal Control Systems Using Nanofluids," Proceedings: Thermal and Fluids Analysis Workshop, NASA Johnson Space Center, Houston, TX, pp. 16.

Vajjha, R.S., Das, D. K. and Kulkarni, D.P., 2010, "Development of New Correlations for Convective Heat Transfer and Friction Factor in Turbulent Regime for Nanofluids," International J. Heat and Mass Transfer, Vol. 53, pp. 4607–4618.

Vajjha, R.S., Das, D. K. and Namburu, P.K., 2010, "Numerical Study of Fluid Dynamic and Heat Transfer Performance of Al_2O_3 and CuO Nanofluids in the Flat Tube of a Radiator," International J. Heat and Fluid Flow, Vol. 31, pp. 613–621.

Strandberg, R.T. and Das, D. K., 2010, "Influence of Temperature and Properties Variation on Nanofluids in Building Heating," Energy Conversion and Management, Vol. 51 pp. 1381-1390.

Strandberg, R.T. and Das, D. K., 2010, "Finned Tube Performance Evaluation with Nanofluids and Conventional Heat Transfer Fluids," International Journal of Thermal Sciences, (2009), Vol.49, pp. 580–588.

Sahoo, B.C. Vajjha, R.S., Ganguli, R., Chukwu, G.A. and Das, D.K., 2009, "Determination of Rheological Behavior of Aluminum Oxide nanofluid and Development of New Viscosity Correlations," Petroleum Science and Technology Journal, Vol. 27, 15, 1757-1770.

Vajjha, R.S., Das, D. K., 2009, "Experimental Determination of Thermal Conductivity of Three Nanofluids and Development of New Correlations", International J. Heat & Mass Transfer, Vol. 52, pp. 4675-4682.

10. Professional Development Activities

- Chair, ASME Graduate Student Technical Conference for Dist. D at University of Nevada, Las Vegas in April 2011.

1. Sunwoo Kim, Ph.D.

2. Education

- Ph.D. 2008 Mechanical Engineering at Duke University, Durham, NC
- M.S. 2005 Automotive Engineering at Hanyang University, Seoul, Korea
- B.S. 2000 Mechanical Engineering at Hanyang University, Seoul, Korea

3. Academic Experience

- Assistant Professor (full time), Mechanical Engineering Department, University of Alaska, Fairbanks, AK, 2010 – present
- Research Assistant Professor (part time), Mechanical Engineering Department, University of Nevada, Reno, NV, 2008-2010
- Graduate Research Assistant (full time), Department of Mechanical Engineering and Materials Science, Duke University, Durham, NC, 2005 – 2008
- Graduate Research Assistant (full time), Department of Automotive Engineering, Hanyang University, Seoul, Korea, 2003-2005

4. Non-academic Experience

- Process Engineer (full time), Atto Co., Ltd., Gyeonggi, Korea, 2000 – 2002
- Duty: product control of semiconductor manufacturing equipment production line

5. Certifications or Professional Registrations

6. Membership in Professional Organizations

7. Honors and Awards

- Invited Participant, NATO Advanced Research Workshop on "Constructal Globalization, Security and Sustainability," Evora, Portugal, 2008
- Engineering Award, the Graduate School at Duke University, 2005 – 2008
- Scholarship, Ilun Science and Technology Foundation, Gyeonggi, Korea, 2005 - 2010
- Scholarship, Korean Research Foundation, 2004
- Scholarship, Industry-Academic Cooperation Fund from Kia Motors, Korea, 2004
- Scholarship, Hanyang University, Korea, 2003
- Best Technical Proposal Award, Atto Co., Ltd., Korea, 2001

8. Service Activities

- Journal Reviewer for International Journal of Thermal Sciences, Heat Transfer Engineering, and Industrial & Engineering Chemistry Research
- Grand Award Judge, Intel International Science and Engineering Fair, Reno, NV, 2009

9. Publications

S. Kim, K Kim, "Dropwise Condensation Model Suitable for Superhydrophobic Surfaces," Journal of Heat Transfer, DOI: 10.1115/1.4003742, Vol. 133, (8), 2011.

Y. Wang, F. Yang, X. Meng, Q. Guo, Z. Zhang, I.-S. Park, **S. Kim**, K Kim, "Simulation Study on the Reaction Process Based Single Stage Metal Hydride Thermal Compressor," *International Journal of Hydrogen Energy*, Vol. 35, pp 321-328, 2010.

S. Kim, S. Lorente, A. Bejan, "Transient Behavior of Vascularized Walls Exposed to Sudden Heating," *International Journal of Thermal Sciences*, Vol. 48, pp 2046-2052, 2009.

S. Kim, S. Lorente, A. Bejan, "Dendritic Vascularization for Countering Intense Heating from the Side," *International Journal of Heat and Mass Transfer*, Vol. 51, pp 5877-5886, 2008.

S. Kim, S. Lorente, A. Bejan, W. Miller, J. Morse, "The Emergence of Vascular Design in Three-Dimensions," *Journal of Applied Physics*, Vol. 103, 123511, 2008.

S. Kim, S. Lorente, A. Bejan, "Vascularized Materials: Tree-Shaped Flow Architectures Matched Canopy to Canopy," *Journal of Applied Physics*, Vol. 100, 063525, 2006.

N. Chung, **S. Kim**, M. Sunwoo, "Nonlinear Modeling and Injection Rate Estimation of Common Rail Injectors for Direct Injection Diesel Engines," *Transactions of JSAE*, Vol. 37, pp 49-54, 2006.

Select Conference Articles

S. Kim, K. Kim, J. Kennedy, J Liu, G Skandan, "Submicron Superhydrophobic Surface Treatment Suitable for High Performance Condensers: A Modeling," *ASME 3rd International Conference on Energy Sustainability (ES2009)*, Paper No. ES2009-90166, Jul. 19-23, 2009, San Francisco, CA, USA.

M. Lee, I. Park, **S. Kim**, K. Kim, "Porous Metal Hydride (PMH) Compacts for Thermal Energy Applications," *ASME 3rd International Conference on Energy Sustainability (ES2009)*, Paper No. ES2009-90361, Jul. 19-23, 2009, San Francisco, CA, USA.

10. Professional Development

1. Jonah. H. Lee

2. Education

- 1983 Ph.D. Engineering Mechanics Iowa State University, Ames, Iowa 50011
- 1979 M.S. Mechanical Engineering, South Dakota School of Mines & Technology, Rapid City, SD 57701
- 1973 B.S. Mechanical Engineering Chung-Yuan Christian University, Chung-Li, Taiwan, Republic of China

3. Academic Experience:

01/84 to Present: **Department of Mechanical Engineering, UAF**
Professor – 07/94 to Present
Department Chair – 07/07 to Present; 07/98 to 06/03
Associate Professor – 07/89 to 06/94
Assistant Professor – 01/84 to 06/89

07/03 to 06/04: **College of Science, Engineering and Mathematics, UAF**
Director, Engineering, Science and Technology Experiment Station

09/01 to 09/03: **Center for Nanosensor Technology, UAF**
Chief Scientist
Deputy Director for Science and Technology
Interim Director - 07/03 to –9/03

4. Non-academic Experience:

09/04 to 08/05 **Office of Naval Research, Arlington, VA**
AAAS Defense Policy Fellow
Program Officer
Division of Physical Sciences S&T
Department of Engineering, Materials and Physical Sciences (Code 33)

12/75 to 12/77 **Taiwan Power Company**
Nuclear Power Division
Mechanical Quality Assurance Engineer

10/73 to 08/75 **Department of Defense, Taiwan, Republic of China**
Project Coordinator, Coaxial Communications Cable

5. Certifications or Professional Registrations

6. Membership in Professional Societies

- American Society of Mechanical Engineers
- American Geophysicl Union
- Society of Automotive Engineers
- International Society for Terrain-Vehicle Systems

7. Recent Awards:

- 2004: Defense Policy Fellowship from American Association for the Advancement of Science (AAAS)
- 2003: Meritorious bonus award of administration from College of Science, Engineering and Mathematics (CSEM), UAF
- 2002: Meritorious bonus award of research from Institute of Northern Engineering (INE), UAF

8. Recent Select Service:

- 2007-Present Department Chair
- 2010 Reviewer for proposals from Switzerland and Luxembourg in snow mechanics and physics
- 2007 Conference Chair, International Society for Vehicle-Terrain Systems (ISTVS), Fairbanks, Alaska

Recent Professional Development:

- 2007-Present International Workshop on Material Point Method

9. Select Recent Key Publications:

1. **Lee, J.H.**, Finite element modeling of interfacial forces and contact stresses of pneumatic tire on fresh snow for combined longitudinal and lateral slips, *J. Terramechanics*, **48** (2011) , 171-197. doi:10.1016/j.jterra.2010.12.003.
2. **Lee, J.H.**, An improved slip-based model for tire-snow interaction, SAE Transactions Journal of Materials and Manufacturing, in press, doi:10.4271/2011-010188.
3. Yuan, H**., Lee, J.H**., Guilkey, J.E., "Stochastic Reconstruction of the Microstructure of Equilibrium Form Snow and Computation of Effective Elastic Properties", *J. Glaciology*, **56** (2010), 405-414.
4. Li, L., Sandu, C**., Lee, J.,** Liu, B., "Stochastic modeling of tire-snow interaction using a polynomial chaos approach", *J. Terramechanics*, **46** (2009), 165-188.
5. **Lee, J.H.,** Wang, W., "Characterization of snow cover using Ground Penetrating Radar for vehicle trafficability – experiments and modeling", *J. Terramechanics* **46** (2009), 189-202.
6. **Lee, J.H.,** "A new indentation model for snow", *J. Terramechanics*, **46** (2009), 1-13.

1. Chuen-Sen Lin

2. Education

- Ph.D. Mechanical Engineering, University of Minnesota, Minneapolis, Minnesota (1988)
- M.S. Mechanical Engineering, University of Hawaii, Honolulu, Hawaii (1978)
- B. S. Mechanical Engineering, National Taiwan Ocean University (1972)

3. Academic Experience

- 1997 - Present Associate Professor, Mechanical Engineering Department, University of Alaska Fairbanks
- 1990 - 1997 Assistant Professor, Mechanical Engineering Department, University of Alaska Fairbanks
- 1988 - 1990 Lecturer, Department of Mechanical Engineering, California State University at Fullerton

4. Non-academic Experience

1998 - 1999 Project Engineering ICRC

Project Engineer:
Piney Point, Maryland and Alexandria, Virginia
HODE project – Modification of a naturally aspirated engine into a turbocharger engine. My duty - Performing cam design and participating in hydraulic cam shaft driver design group and performance testing group.

Madison Height, Michigan
Multi-tasking Truck Project– Converting a single purpose truck into a multi-tasking truck (personnel carrier, dumpster, towing, container, general cargo, medical center).
My duty - Performing kinematic and FEM analysis and participating in design group.

1973 - 1975 Marine Engineer China Transport Company
Taiwan, Republic of China
Field engineer:
My duty – Operation, trouble shooting, and maintenance of diesel engines and a HVAC/R system.

5. Certifications or Professional Registrations

6. Membership

- ASME, Pi-Tau-Sigma, ASEE, SAE, ACS

7. Honors and Awards

8. Professional/Public Service

- Paper review for – Mechanisms and Machine Theory
    - ASME Journal of Mechanical Design
    - ASME Mechanisms Conference

    - SAE Papers
- Book review for – Cambridge publishing company
- Proposal review – Estonian Science Foundation

9. Selected Research Publications

- K. Avadhamula, C.S. Lin, d. Witmer, J. Schmid, and P. Kandulapati, "Experimental Study of the Performance of a Stationary Diesel Engine Generator with Hydrogen Supplementation," 2009, Energy and Fuels, 23 (10), pp 5062–5072.
- P. Raghupatruni, C. S. Lin, D. Witmer, E. Bargar, J. Schmid, T. Johnson, V. Avadhamula, 2008, , "An Experimental Feasibility Study of Using Diesel Exhaust for Heating," WIT Transactions on Engineering Sciences, Vol. 61, pp 93-104.
- P. Kandulapati, C. S. Lin, D. Witmer, T. Johnson, J. Schmid, and T. Kenny, 2007, "A Study on Adaptability of the Engine Control Module of an Existing Heavy Duty Diesel Engine to Optimize the Engine Performance with F-T Diesel Fuel," 2007 JRCICE-40076.
- A Telang, D. Witmer, C. S. Lin, J. Schmid, T. Johnson, and T. Kenny, 2006, "Testing of Syntroleum Synthetic Diesels in Diesel Generators Suitable for Alaska," ICEF2006-1588.

10. Recent Activities
Research-

- Test Evaluation of ORC Operating on Recovered Heat from Diesel Engine Exhaust, 2009-2010, AEA (funded).
- Optimization of ORC system performance from Diesel Engine Exhaust, 2003-2006, AETDL (Funded).
- Study of the Performance of a Stationary Diesel Engine Generator with Hydrogen Supplementation (not funded).

Teaching-

- 2008 Attended a three-day short course, "GT-Power, Basic and Advanced," Detroit, Michigan.
- 2008 Attended a five-day short course, "LMS Virtual Motion Lab," Detroit, Michigan.
- 2007 Attended a four-day Short Course, "CamWorks," Fresno, California.
- 2007 Attended a four-day Short Course, "SolidWorks-1," Fresno, California.
- 2007 Attended an on-day Short Course, "Lab View," Fairbanks, Alaska.

Services-

- Invited work shop presentations - Exhaust Heat Recovery for Rural Alaska Energy Development, 2007, Alaska Energy Authority, Anchorage, Alaska.

1. Jifeng Peng

2. Education

- Ph.D., Bioengineering (07/2009) California Institute of Technology, Pasadena, CA
- M.S., Mechanical Engineering (06/2004) Stony Brook University, Stony Brook, NY
- B.S., Mechanical Engineering (06/2002) University of Science & Technology of China, Hefei, China

3. Academic Experience

- Assistant Professor (08/2009 – present)
- Mechanical Engineering, University of Alaska Fairbanks, Fairbanks, AK

4. Non-academic Experience

5. Certifications or Professional Registrations

6. Professional Affiliations

- American Physical Society
- American Society of Limnology and Oceanography
- American Society of Mechanical Engineers
- Society for Integrative and Comparative Biology

7. Honors and Awards

8. Academic Service

- Referee (2009 – present)
- Atmospheric Environment
- Bioinspiration & Biomimetics
- Chaos
- Experiments in Fluids
- International Journal of Heat and Fluid Flow
- International Journal of Non-linear Mechanics
- Journal of Experimental Biology
- Journal of the Japanese Society for Experimental Mechanics
- Journal of Physics: Condensed Matter
- Marine Technology Society Journal
- Physica D: Nonlinear Phenomena
- Theoretical and Computational Fluid Dynamics
- Session Chair, American Physical Society Division of Fluid Dynamics Annual Meeting (2010)

9. Peer-Reviewed Publications

Sapsis T, **Peng J**, Haller H (2011) "Instabilities on prey dynamics in jellyfish feeding," Bulletin of Mathematical Biology, to appear.

Wilson M, **Peng J**, Dabiri JO, Eldredge JD (2009) "Lagrangian coherent structures in low

Reynolds number swimming," *Journal of Physics: Condensed Matter* 21: 204105.
Peng J, Dabiri JO (2009) "Transport of inertial particles by Lagrangian Coherent Structures: application to predator-prey interaction in jellyfish feeding," *Journal of Fluid Mechanics* 623: 75-84.
Peng J, Dabiri JO (2008) "The 'upstream wake' of swimming and flying animals and its correlation with propulsive efficiency," *Journal of Experimental Biology* 211: 2669-2677.
Peng J, Dabiri JO (2008) "An overview of a Lagrangian method for analysis of animal wake dynamics," *Journal of Experimental Biology* 211: 280-287.
Franco E, Pekarek DN, **Peng J**, Dabiri JO (2007) "Geometry of unsteady fluid transport during fluid-structure interactions," *Journal of Fluid Mechanics* 589: 125-145.
Peng J, Dabiri JO (2007) "A potential-flow, deformable-body model for fluid-structure interactions with compact vorticity: application to animal swimming measurements," *Experiments in Fluids* 43: 655-664.
Peng J, Dabiri JO, Madden PG, Lauder GV (2007) "Non-invasive measurement of instantaneous forces during aquatic locomotion: A case study of the bluegill sunfish pectoral fin," *Journal of Experimental Biology* 210: 685-698.

10. Professional Development Activities

- 2010 APS DFD Annual Meeting Oral presentation November 2010
- 2010 Natural Locomotion Workshop Oral presentation June 2010
- 2010 AGU Fall Meeting Poster presentation December 2009
- 2009 APS DFD Annual Meeting Oral presentation November 2009

1. **Rorik A Peterson**

2. **Education**
   - Univ. California, San Diego. B.S. Chemical Engineering 1994.
   - Univ. Colorado, Boulder. M.S. Chemical Engineering 1996.
   - Univ. Colorado, Boulder. Ph.D. Chemical Engineering 1999.
   - Dissertation title: *Differential frost heave manifest as patterned ground - modeling, laboratory and field studies*

3. **Academic Experience**
   - 2004 – present: Asst. Professor, Mechanical Engineering, University of Alaska, Fairbanks.
   - 2000-2001: Postdoctoral Research Associate, Institute of Arctic Biology and The Geophysical Institute, Univ. Alaska, Fairbanks.
   - 1999-2000: Postdoctoral Research Associate, Oxford Centre for Industrial and Applied Mathematics, University of Oxford, UK.
   - 1999: College Tutor, Corpus Christi College, University of Oxford, UK. I*ntegral and differential equations.*
   - 1999: Postdoctoral Research Associate, Center for Membrane Applications and Separations Technology, Univ. Colorado, Boulder.
   - 1997-1999: Graduate Research Assistant, Institute for Arctic and Alpine Research and Dept. of Chemical Engineering, Univ. Colorado, Boulder.
   - 1995-1997: Graduate Research Assistant, Center for Separations using Thin Films and Dept. of Chemical Engineering, Univ. Colorado, Boulder.

4. **Non-academic Experience**
   - 2001-2004: Research Programmer, Remote Sensing and Volcanology, Geophysical Institute, Univ. Alaska, Fairbanks.

5. **Certifications and Professional Registrations**

6. **Current Memberships**
   - American Society of Mechanical Engineers (ASME)
   - American Institute of Chemical Engineers (AIChE)
   - American Society for Engineering Education (ASEE)

7. **Honors and Awards**
   - 2009, 2011 – ASME Outstanding Faculty, UAF Student Section.
   - 2010 – CEM Merit Award for Teaching and Student Mentorship
   - 1999-2000 - Marshall Sherfield Postdoctoral Fellowship, University of Oxford, UK.

8. **Service Activities**

- ABET compliance coordinator for Mechanical Engineering department
- M.S. program admissions committee member for Mechanical Engineering
- Ph.D. program admissions committee member for College of Engineering
- ASME student section advisor for UAF section
- UAF campus Master Plan Update Working Group representative for College of Engineering

9. Publications and Presentations

- RA Peterson (2010) "Assessing the role of differential frost heave in the origin of non-sorted circles" *Quaternary Research* doi:10.1016/j.yqres.2010.08.003
- RA Peterson and WB Krantz (2008) "Differential frost heave model for patterned ground formation: Corroboration with observations along a North American arctic transect" *J. Geophys. Res*. 113, G03S04, doi:10.1029/2007JG000559.
- RA Peterson. (2008) "Stability analysis and numerical simulation of differential frost heave" *Mathematical Geosciences,* 40(3), 277-298, doi:10.1007/s11004-008-9150-z.
- RA Peterson and KG Dean (2008) "Forecasting exposure to airborne volcanic ash based on ash dispersion modeling", *J. Volcanology and Geothermal Res.* 170, 230-246 doi:10.1016/j.volgeores.2007.10.003.
- RA Peterson "Deformation and failure in frozen rock and soils" Gordon Research Conference: Rock Deformation, Tilton NH (Aug 2010) (invited).
- RA Peterson. "Role of differential frost heave in the initiation of patterned ground" Linc Washburn Memorial Workshop (2008), Fairbanks AK, USA (invited).
- RA Peterson. "Numerical modeling of differential frost heave", 9th ICOP (2008), Fairbanks, AK, USA.
- RA Peterson. "Thermal Boundary Effects On Pattern Formation Due to Differential Frost Heave" European Geophysical Union General Assembly 2006, Vienna, Austria.

10. Professional Development

- 2010 – Attended the Frontiers of Engineering Education workshop of the National Academy of Engineering, Irvine CA.
- 2009 – Attend spring ABET Best Practices workshop, Indianapolis IN

1. Gang Sheng (Gang Chen)

2. Education

- Doctor of Philosophy in Civil and Environmental Engineering, Nanyang Technological
- University, Singapore, 1997
- Master of Science in Mechanical Engineering, Shanghai Jiao Tong Univ, China, 1987
- Bachelor of Science in Mechanical Engineering, Shanghai Jiao Tong Univ, China, 1984

3. Academic experience

- Assistant Professor, Department of Mechanical Engineering, UAF 2008-present
- Research Assistant, Nanyang Technological University, Singapore, 1993-1996
- Assistant professor/lecturer, Depart of Mechanical Engineering, Huazhong Univ.
- of Science and Technology, China, 1987-1993

4. Non-academic experience

- Research Scientist, Technical Center, Gates Corporation, Michigan, 2002-2008
- Advisory Scientist, Storage Technical Division, IBM Corporation, CA, 2001-2002
- Principal Engineer/group leader, Singapore Research Lab, SONY Corp., 2000-01
- Principal engineer, senior engineer, National Lab (DSI), National University of
- Singapore, 1996 -2000

5. Certifications or professional registrations

6. Current membership in professional organizations: ASME, SAE

7. Honors and awards

- Fellow of American Society of Mechanical Engineers, elected in fall 2008
- Author Achievement Award, Gates Corporation, 2006.
- Award of Evaluation of Patent Invention, Sony Corp., Singapore Research Lab, 2000.
- 1st Grade Awards of Excellent Book, The Ministry of Mechanical Industry of China,1996, for his co-authored book Mechanical Vibration System (published in 1991, with Hanmin Shi and Ya Wu).

8. Service activities (within and outside of the institution)

- Member of editorial board, Int. Journal of Vehicle Noise and Vibration, 2009-
- Section editor (condition-based monitoring), book Encyclopedia of Tribology, Springer, 2009-
- Member of SAE TC127/SC2 technical committee, Society of Automotive Engineer International, 2008-
- Guest Editor, special issue of Int. Journal of Vehicle Noise and Vibration, 2008
- Session Chair of Advanced Powertrain Technology in Global Powertrain Congress 2006, Plymouth, Michigan, Sept., 2006.
- Chair of NVH session, SAE International powertrain, fuel & lubrication conference, Shanghai, China, June 2008.

- Organizer/Chair of Noise & Vibration Session, SAE International powertrain, fuel & lubrication global congress 2009, Florence, Italy. June, 2009.
- Organizer of NVH Session, SAE International powertrain, fuel & lubrication US conference, San Ontario, TX, Nov., 2009.
- Organizer of Powertrain NVH Session, SAE International Congress, Detroit, April, 2010.
- Organizer of Powertrain NVH Session, SAE International 2010 PF&L Meeting, Brazil, August, 2010.
- Organizer of Powertrain NVH Session, SAE International Congress, to be held in Detroit, April, 2011.
- Organizer of Powertrain Characterization Session, SAE International powertrain, fuel & lubrication conference, to be held in Japan, August, 2011.

9. Publications and Presentations

- Sheng, G., Huang, L., Chang, J.Y., He J., Duan, S.L., An approach for non-stationary and nonlinear vibration control of active air-bearing slider systems, J Microsystem Tech.,2011, http://www.springerlink.com/content/11w012850u1w7222
- Sheng G., He J.Z., Duan S.L., Identification of the spectrum signature of air-bearing slider dynamics, Tribology Letters, 41, 1, 2011.
- Sheng G., Vehicle Vibrations and Sound (a definitive book), under publication, SAE International Publishing.
- He J.Z., Sheng G., Hopkins J., Duan S.L., and Johnson K., Head and media instantaneous contact friction measurement and glide test. IEEE Transaction of Mag. 46, 10, 3767-3771, 2010
- Sheng G., He J.Z., Duan S.L., Analysis of transient contact response of a sub-10 nanometer airbearing slider (pico glide head) using empirical mode decomposition, ASME Trans. Journal of Tribology. 2011 in press,
- Sheng G., Sensing and Identification of nonlinear dynamics of slider with clearance in sub-5 nanometer regime (Invited), Advance in Tribology, Hindawi Publishing Corp., 2011, in press.
- Sheng G., Lee J., Narravula V., Song D, Experimental characterization and analysis of wet belt friction and the vibro-acoustic behavior, Tribology International. 44, 3, 2011.
- Qatu M S, Abdelhamid M K, Sheng G., Overview of automotive noise and vibration, Int. J. Vehicle Noise and Vibration, Vol. 5, Nos. 1/2, 2009.
- Sheng G., Lee J.H., Friction-vibration interactions, in Encyclopedia of Tribology, Springer, under publication.
- Xu J., Sheng, G., Characterization of light contact in head disk interface with dynamic flying height control, J Microsystem Tech., 2011, Available online:
- http://www.springerlink.com/content/m355jxu595353685/fulltext.pdf
- Sheng G., He J.Z., Duan S.L., Disk roughness and defect monitoring for ultrahigh density computer hard disk drive, in Encyclopedia of Tribology, Springer, under publication.
- Sheng G, Handling Dynamics Problems and Solutions (book chapter), in Book edited by R Dukkipati et al: Road Vehicle Dynamics Problems and Solutions, SAE International publishing, 2010.

- Sheng G., Zheng, H., Qatu, M., Dukkipati, R.V., Modeling of friction-induced noise of timing belt, International Journal of Vehicle Noise and Vibration Vol. 4,No.4, 285 - 303, 2008.
- Sheng G, Handling Dynamics (book chapter) in Book edited by R Dukkipati et al.: Road Vehicle Dynamics, SAE International publishing, 2008.

10. Professional Development

1. Jing Zhang

2. Education

- Ph.D., Materials Science and Engineering, Drexel University, 2004
- M.S., Manufacturing Engineering, Beijing Univ. of Aeronautics and Astronautics, 1999
- B.S., Metal Forming, University of Science and Technology Beijing, 1996

3. Academic experience

- University of Alaska Fairbanks, Fairbanks, Department of Mechanical Engineering, Assistant Professor, 2005-present, full-time
- Rensselaer Polytechnic Institute, FOCUS Center - New York, Postdoc Research Fellow, 2004-2005, full-time
- Research/Teaching Assistant, Drexel University, 2000-2004, full-time

4. Nonacademic experience

5. Certifications or professional registrations

6. Current membership in professional organizations

- Materials Research Society

7. Honors and awards

- Feist/Schamel Outstanding Faculty Advisor Award, U. of Alaska Fairbanks, 2010
- Marquis Who's Who in America, 2009
- U.S. Air Force Summer Faculty Fellow, U.S. Air Force 2008
- National Science Foundation Nanomechanics Institute Fellow, National Science Foundation and Northwestern University, 2008
- Feist/Schamel Outstanding Faculty Advisor Award, U. of Alaska Fairbanks, 2008
- Alaska NSF/EPSCoR Early CAREER Award, 2008
- Marquis Who's Who in Science and Engineering, 10th Edition, 2008
- Honorary Faculty/Staff, Department of Athletics, Univ. of Alaska Fairbanks, 2007

8. Service activities

- Editorial Board: International Journal of Engineering, Applied Physics Research,
- Journal Reviewer: Microelectronic Engineering, Microelectronics Reliability, IEEE Transactions on Industrial Electronics, Materials Science and Engineering A, Metallurgical and Materials Transactions B, MRS Bulletin, Materials Research (Brazil), Scientific Journal of International
- Advisory Panelist of books published by Elsevier
- Proposal review panelist: NSF (sustainable energy, small business)
- Proposal reviewer: Oklahoma State No Child Left Behind (NCLB) Program, Georgia National Science Foundation

9. Most important publications in the past 5 years

1. Zhizhong Jia, **Jing Zhang**, Chengchang Jia, Junhui Nie, "Preparation and Characterization of Mechanical Properties of Carbon Nanotube/45S5Bioglass Composites for Biologic Applications", *Materials Science and Engineering A*, Vol. 528, Issue 3, pp.1553-1557, 2011
2. **Jing Zhang**, Yanhong Gu, "Effect of Al/Ti ratio on the mechanical properties and tribological behaviors of TiAlN coatings deposited by multi-arc ion plating method", *Journal of Engineering Tribology*, in press
3. Qimao Liu, **Jing Zhang** and Liubin Yan, "An Accurate Method for Dynamic Response First and Second Derivative Calculations", *Journal of Mechanics*, in press
4. **Jing Zhang**, A. Zavaliangos, "Discrete Finite Element Simulation of Thermoelectrical Phenomena in Spark Plasma Sintering", *Journal of Electronic Materials*, (doi: 10.1007/s11664-011-1606-0), available online.
5. Qimao Liu, **Jing Zhang** and Liubin Yan, "An Accurate Method for Dynamic Response First and Second Derivative Calculations", *Journal of Mechanics*, in press.
6. Yanhong Gu, **Jing Zhang**, Wenming Xiong, Chengyun Ning, "Residual stresses in microarc oxidation ceramic coatings on biocompatible AZ31 magnesium alloys", *Journal of Materials Engineering and Performance*, in press.
7. N. Nagabhushana, T. Nithyanantham, S. Bandopadhyay, **J. Zhang**, "Subcritical Crack Growth Behavior of A Perovskite-type Oxygen Transport Ceramic Membrane", *International Journal of Applied Ceramic Technology*, in press, (doi:10.1111/j.1744-7402.2009.02440.x), available online.
8. Qimao Liu, **Jing Zhang**, Liubin Yan, "A Numerical Method of Calculating First and Second Derivatives of Dynamic Response Based on Gauss Precise Time Step Integration Method", *European Journal of Mechanics - A/Solids*, Vol. 29, Issue 3, pp. 370–377, 2010
9. Qimao Liu, **Jing Zhang**, Liubin Yan, "An Optimal Method for Seismic Drift Design of Concrete Buildings Using Gradient and Hessian Matrix Calculations", *Archive of Applied Mechanics*, Vol. 80, Number 11, pp. 1225-1242, 2010
10. **J. Zhang**, "A Study of Compaction of Composite Particles by Multi-Particle Finite Element Method", *Composites Science and Technology*, Vol. 69, Issue 13, pp. 2048-2053, 2009
11. Qimao Liu, **Jing Zhang**, Liubin Yan, "Response sensitivity and Hessian matrix analysis of planar frames subjected to earthquake excitation", *Finite Elements in Analysis & Design*, Vol. 45, pp. 695-709, 2009
12. **Jing Zhang**, Deben Das, Rorik Peterson, "Selection of Effective and Efficient Snow Removal and Ice Control Technologies for Cold-Region Bridges", *Journal of Civil, Environmental, & Architectural Engineering*, Vol. 3, Issue 1, pp. 1-14, 2009
13. **J. Zhang**, T. Nithyanantham, S.N. Thangavel, S. Biswas, S. Bandopadhyay, "Modeling of Indentation Studies of Reduced Porous Ni-8YSZ Anode and Electrolyte Structures", *ECS Transactions*, **13**(6), pp. 13-19, 2008

10. Recent professional development activities

- Attended a Webinar: "Abaqus 6.9 Extended Functionality (6.9-EF) Overview" on November 17, 2009.
- Attended a short video on teaching incident organized by the UAF office of faculty development on July 23, 2010.

Appendix C – Equipment

Please list the major pieces of equipment used by the program in support of instruction.

ME 308 – Measurement and Instrumentation Lab

1. Stroboscope tachometers
2. Contact/photo tachometers
3. Digital strain indicators
4. Sound level meters
5. Precision tabletop scales
6. A precision drum scale
7. Digital oscilloscopes
8. Digital function generators
9. Micrometers, dial calipers, and precision gage blocks
10. Digital multi-meters with various attachments
11. National Instruments DAQ systems
12. Vernier LabPRO dataloggers
13. Vishay strain tester

ME 321 – Industrial Processes

1. Haas VF-2 vertical machining center
2. Haas SL-20 turning center
3. Haas TL-2 lathe
4. 4 manually operated lathes
5. 2 manually operated vertical milling machines
6. horizontal bandsaw
7. vertical bandsaw
8. belt grinder
9. bench grinder
10. drill bit sharpener

ME 334 – Materials Science Engineering Lab

1. Buehler Micromet microhardness tester
2. Buehler Minemet grinder / polisher
3. Charpy impact test hammer
4. Instron tensile tester

ME 403 – Machine Design

1. MAXNC T2 and MAXNC 15: These are computer numerical controlled desktop lathe and milling machines
2. ThermoJet Solid Project Printer
3. HAAS CNC turning center and HAAS vertical center

ME 415 – Thermal Systems Lab

1. Digital viscometer
2. Transient natural convection apparatus
3. 45 kW diesel-electric generator
4. Cussons gas turbine system
5. Steam generator for heat transfer experiments
6. Heat conduction in rods experimental setup
7. Boiling heat transfer apparatus
8. Refrigeration cycle test unit
9. Rankine cycle unit
10. Labview-based data acquisition system
11. Two thermal conductivity measuring systems
12. Centrifugal pump test loop
13. Wall-mounted annular heat exchanger experiment

Appendix D – Institutional Summary

Programs are requested to provide the following information.

1. The Institution

a. Name and address of the institution

University of Alaska Fairbanks
PO Box 757500
Fairbanks, Alaska 99775-7500
www.uaf.edu

b. Name and title of the chief executive officer of the institution

Pat Gamble, UA System President
Brian Rogers, UAF Chancellor

c. Name and title of the person submitting the self-study report.

Rorik Peterson, Associate Professor
Department of Mechanical Engineering

d. Name the organizations by which the institution is now accredited and the dates of the initial and most recent accreditation evaluations.

The university has been accredited by the Northwest Commission on Colleges and Universities since 1934. The most recent full-scale accreditation evaluation was in 2001. This was followed in 2006 by a five-year interim report. The next NWCCU accreditation self-study will be submitted in fall 2011.

1. Type of Control

Description of the type of managerial control of the institution, e.g., private-non-profit, private-other, denominational, state, federal, public-other, etc.

State and Federal.

2. Educational Unit

Describe the educational unit in which the program is located including the administrative chain of responsibility from the individual responsible for the program to the chief executive officer of the institution. Include names and titles. An organization chart may be included.

The College of Engineering and Mines (CEM) is organized into six departments:

a. Civil and Environmental Engineering
b. Computer Science

c. Electrical and Computer Engineering
d. Mechanical Engineering
e. Mining and Geological Engineering
f. Petroleum Engineering, and

offers the following programs

- Arctic Engineering M.S.
- Civil Engineering B.S., M.C.E., M.S.
- Computer Engineering B.S.
- Computer Science B.S., M.S.
- Construction Management graduate certificate
- Electrical Engineering B.S., M.E.E., M.S.
- Engineering Ph.D.
- Engineering Management M.S.
- Environmental Quality Engineering M.S.
- Environmental Quality Science M.S.
- Geological Engineering B.S., M.S.
- Mechanical Engineering B.S., B.S/M.S., M.S.
- Mineral Preparation Engineering M.S.
- Mining Engineering B.S., M.S.
- Petroleum Engineering, B.S., M.S.
- Science Management M.S.

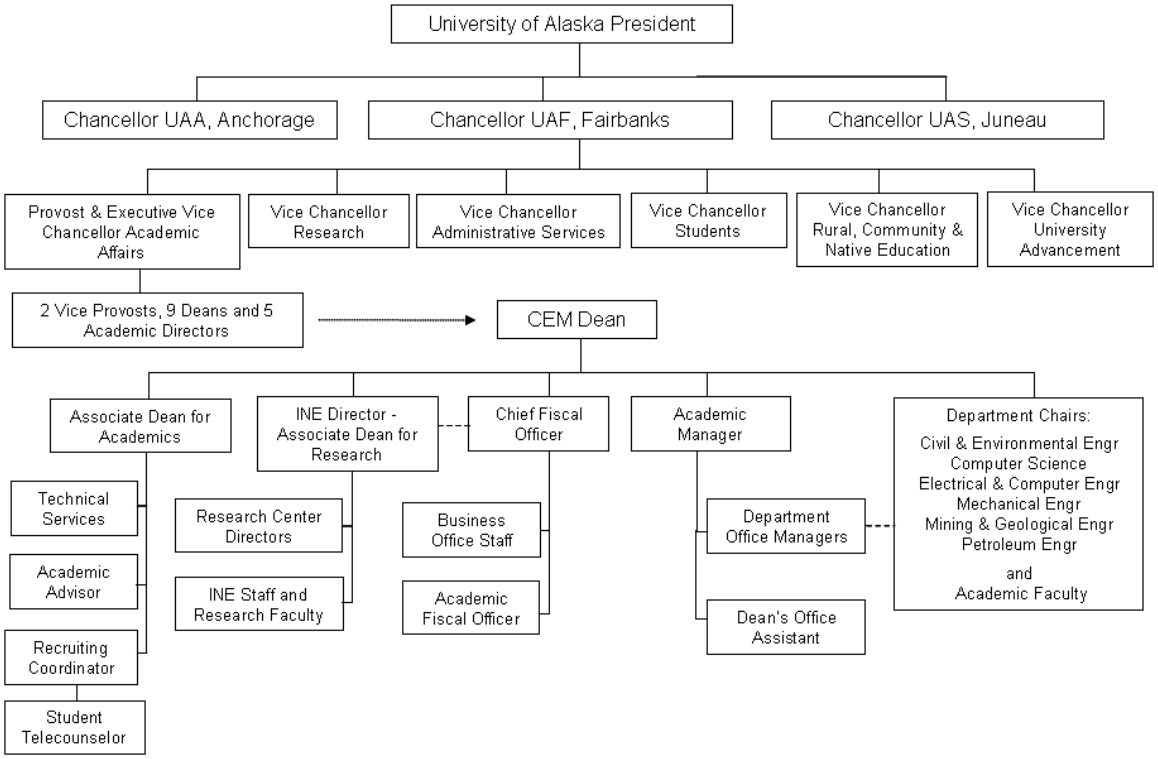
The FY 10 enrollment in the college was 672 undergraduate students and 146 graduate students, and there were 101 degrees awarded. Grant-funded research expenditures in INE (Institute of Northern Engineering) totaled $14,306,000 in FY 10, with total research expenditures of $18,184,000.

The Computer Science department joined CEM in FY11, and with the addition of their 7 faculty, CEM/INE currently has 59 faculty, including 6 that are research only, and 46.5 staff members.

The college organization chart is below. The top level administration from the chart is:
CEM Dean – Douglas Goering
Associate Dean for Instruction – Charlie Mayer
INE Director – Associate Dean for Research – Daniel White
Chief Fiscal Officer – Nickole Conley
Academic Manager – Linda Ilgenfritz
Civil and Environmental Engineering Department Chair – David Barnes
Computer Science Department Chair – Kara Nance
Electrical and Computer Engineering Department Chair – Charlie Mayer
Mechanical Engineering Department Chair – Jonah Lee
Mining and Geological Engineering Department Chair – Rajive Ganguli
Petroleum Engineering Department Chair – Catherine Hanks

The CEM Dean reports to the UAF Provost, Susan Henrichs, who reports to the UAF Chancellor, Brian Rogers, who reports to the UA President, Pat Gamble.

College of Engineering and Mines within the University of Alaska
Organizational Chart



3. Academic Support Units

List the names and titles of the individuals responsible for each of the units that teach courses required by the program being evaluated, e.g., mathematics, physics, etc.

Chemistry, John Keller, Chemistry and Biochemistry Department Chair
Math, Anthony Rickard, Mathematics and Statistics Department Chair
Physics, Ataur Chowdhury, Physics Department Chair
English, Rich Carr, English Department Chair
College of Liberal Arts (CLA), Burns Cooper, Interim Dean College of Liberal Arts. CLA offers the general education requirement courses.

4. Non-academic Support Units

List the names and titles of the individuals responsible for each of the units that provide non-academic support to the program being evaluated, e.g., library, computing facilities, placement, tutoring, etc.

Libraries [http://www.uaf.edu/uaf/academics/libraries], Responible Individual: Paul McCarthy, Interim Dean of Libraries.

UAF computing facilities are operated by OIT (Office of Information Technology); [www.uaf.edu/oit], Responsible Individual: Steve Smith, Chief Information Technology Officer.

UAF Academic Advising Center provides placement testing and advising; [www.uaf.edu/advising], Responsible Individual: Linda Hapsmith, Director.

Tutoring is provided within the academic units. The Department of Mathematical Sciences (DMS) provides daily tutoring in the Math Lab, located in the Chapman Building [http://www.dms.uaf.edu/dms/MathLab/MathLabIntro.html], Responsible Individual: Latrice Laughlin, Instructor, Department of Mathematics and Statistics. The Engineering Tutoring Lab is located in the Duckering Building and is manned 6 days a week by engineering student tutors, Responsible Individual: Charlie Mayer, Associate Dean for Instruction, CEM.

5. Credit Unit

It is assumed that one semester or quarter credit normally represents one class hour or three laboratory hours per week. One academic year normally represents at least 28 weeks of classes, exclusive of final examinations. If other standards are used for this program, the differences should be indicated.

The standard definition of credit hour applies at UAF: 1 credit hour represents 1 hour of class per week (or three laboratory hours per week) for 14 weeks per semester.

6. Tables

Complete the following tables for the program undergoing evaluation.

Table D-1. Program Enrollment and Degree Data

Name of the Program

	Academic Year		Enrollment Year					Total Undergrad	Total Grad	Degrees Awarded			
			1st	2nd	3rd	4th	5th			Associates	Bachelors	Masters	Doctorates
Current Year		FT	47	37	28	43		155	12	0	22	6	0
		PT	6	2	3	9		20	4				
1		FT	53	28	28	37		146	10	0	25	2	1
		PT	5	4	3	6		18	3				
2		FT	44	23	17	37		121	8	0	17	2	1
		PT	7	3	4	3		17	3				
3		FT	32	18	20	28		98	7	0	13	4	2
		PT	5	1	4	2		12	2				
4		FT	23	20	16	27		86	12	0	8	8	0
		PT	5	1	2	1		9	4				

Give official fall term enrollment figures (head count) for the current and preceding four academic years and undergraduate and graduate degrees conferred during each of those years. The "current" year means the academic year preceding the fall visit.

FT--full time
PT--part time

Table D-2. Personnel

Mechanical Engineering

Year[1]: __2010_____

	HEAD COUNT		FTE[2]
	FT	PT	
Administrative[3]	1	0	1
Faculty (tenure-track)	9	0	9
Other Faculty (excluding student Assistants)	0	0	0
Student Teaching Assistants	5	0	5
Student Research Assistants	8	0	8
Technicians/Specialists	1	1	1.5
Office/Clerical Employees	0	0	0
Others[4]			

Report data for the program being evaluated.

[1] Data on this table should be for the fall term immediately preceding the visit. Updated tables for the fall term when the ABET team is visiting are to be prepared and presented to the team when they arrive.

[2] For student teaching assistants, 1 FTE equals 20 hours per week of work (or service). For undergraduate and graduate students, 1 FTE equals 15 semester credit-hours (or 24 quarter credit-hours) per term of institutional course work, meaning all courses — science, humanities and social sciences, etc. For faculty members, 1 FTE equals what your institution defines as a full-time load.

[3] Persons holding joint administrative/faculty positions or other combined assignments should be allocated to each category according to the fraction of the appointment assigned to that category.

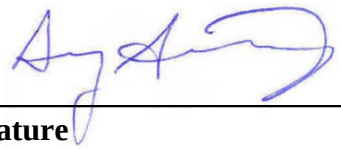
[4] Specify any other category considered appropriate, or leave blank.

Signature Attesting to Compliance

By signing below, I attest to the following:

That the **B.S. Mechanical Engineering Program** has conducted an honest assessment of compliance and has provided a complete and accurate disclosure of timely information regarding compliance with ABET's *Criteria for Accrediting Engineering Programs* to include the General Criteria and any applicable Program Criteria, and the ABET *Accreditation Policy and Procedure Manual.*

_Douglas J. Goering_____
Dean's Name (As indicated on the RFE)



_____ **__June 24, 2011_____**
Signature **Date**