ABET
Self-Study Report

for the

Bachelor of Science in Materials Engineering

at

Iowa State University

Ames, IA

June 30, 2012

CONFIDENTIAL

Table of Contents

BACKGROUND INFORMATION

A. Contact Information

The primary contact person is University Professor Larry Genalo, Associate Chair for Undergraduate Programs, 2220A Hoover Hall, Ames, IA 50010, (515) 294-4722, FAX (515) 294-5444, genalo@iastate.edu. Genalo will be out of the country (but still checking e-mail) until July 15th, so a secondary contact is Professor Kristen Constant, 2220J Hoover Hall, Ames, IA 50010, (515) 294-3337, FAX (515) 294-5444, constant@iastate.edu.

B. Program History

The Materials Engineering degree was established in 1999 after careful study of the changing needs of our constituents, including students, industrial partners, alumni, and the faculty. After incorporating all the inputs and deliberating in various forums, the faculty determined that it was best to combine the two individual degree programs in Ceramic Engineering and Metallurgical Engineering into a single program (Materials Engineering). This program provides an integrated background in materials and requires the student to select two areas of specialization from four: ceramic, electronic, metallic and polymeric materials. The program is unique in the sense that it provides the breadth of materials engineering while allowing students to achieve depth in two (or more) of four specializations within the materials field. Thus, we believe the curriculum provides the necessary breadth yet sufficient depth in two specialization areas of the student's choice. It is clear from increasing enrollments over the past 13 years that the new program has indeed attracted highly qualified students and has resulted in more diverse employment opportunities for our graduates.

The program was last reviewed by ABET in the fall of 2006. Since the last general review, along with some more minor changes, we have increased the fundamentals coverage in the materials core curriculum in the sophomore year from five to eight credits and implemented a junior year, three-credit electronic materials course, also in the core. The number of total materials credits remained the same since we simultaneously reduced the two specialties that students select from four to three courses each. However, we increased the total credits for graduation with the addition of five mathematics credits; third semester calculus (multivariable, for four credits) and changing to the differential equations course that includes Laplace Transforms (one additional credit).

C. Options

The Materials Science and Engineering department offers a degree in Materials Engineering. Although this degree does not have official options, a student is required to select two specializations by taking three courses in each specialization. The areas of specialization are:
Ceramic Materials
Electronic Materials
Metallic Materials
Polymeric Materials

Each specialization is a three course sequence taken in the third and fourth years. Additional specialization courses, including courses primarily for graduates are offered as technical electives for students who desire additional depth (by taking courses in the designated area of specialization) or breadth (in the other areas of specialization). There is also the ability for qualified students to propose their own materials-based specialization. If approved by the curriculum committee, they would then choose one of the four options listed above and also do their own three-course specialization in a materials-related area that integrates with their career goals. To date only a handful of students have done this and most of those did a biomaterials specialization.

D. Organizational Structure

Iowa State University is governed by the State of Iowa Board of Regents. The President is the chief executive officer of the university. The Provost is the chief academic officer of the university to whom the individual deans report. The Dean of Engineering is the chief executive officer of the College of Engineering.

Organization charts are given in Figures 1 (Iowa State University) and 2 (College of Engineering). Complete organization charts can be found here:

- Iowa State University: http://www.president.iastate.edu/org/univorg.pdf
- College of Engineering: http://www.engineering.iastate.edu/the-college/office-of-the-dean/coe-organizational-chart/

Within the department's program there is an Associate Chair for the Undergraduate Program and Administration who reports to the Department Chair. That Associate Chair also Chairs the Undergraduate Curriculum Committee within the department, is a member of the college's curriculum committee, and is the ABET coordinator for the program. Suggested changes in the program are first considered by the department's curriculum committee and, if approved, brought to the entire department faculty for consideration and vote on approval. Approved changes must then be submitted with all other catalog information (catalogs are created annually) and approved by the college's curriculum committee and the entire faculty of the college. Having achieved that, the changes must once again be reviewed and approved at the university level by the Faculty Senate Curriculum Committee and the entire Faculty Senate.

Figure 1. Iowa State University organization chart.

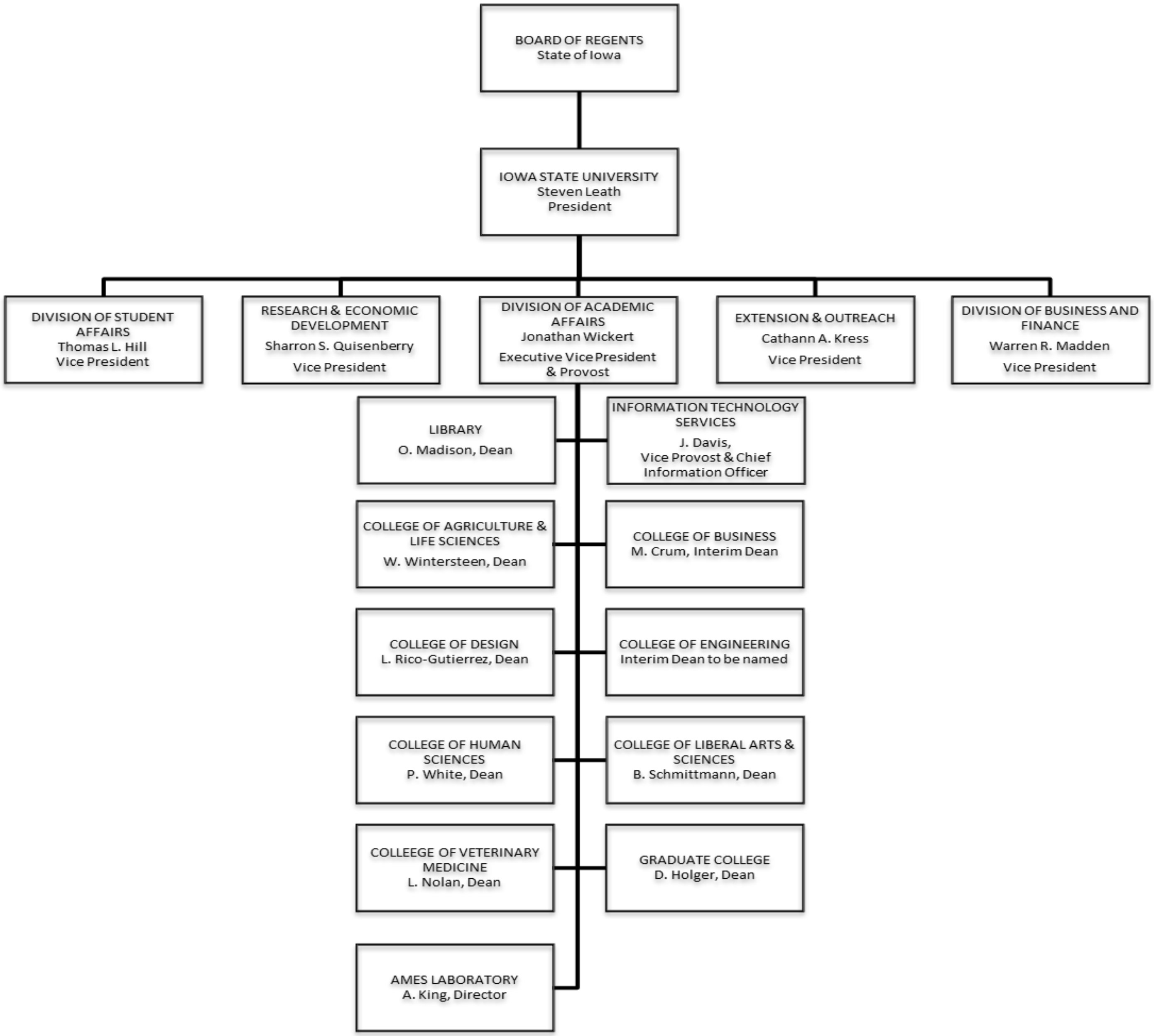
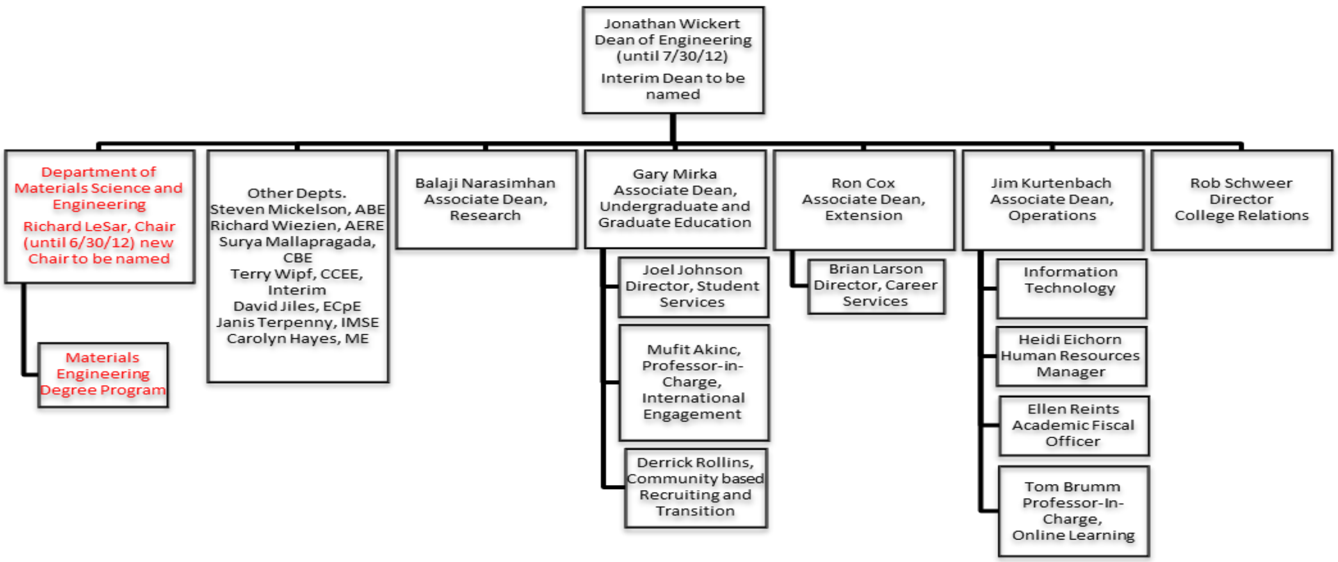


Figure 2. College of Engineering organization chart.



E. Program Delivery Modes

Materials Engineering is a day program. For the most part, all courses and laboratories are offered during working hours. Some courses are offered online or at a distance, but most students enroll in day classes with classroom/laboratory instruction.

The MSE department at Iowa State University encourages its students to engage in experiential education (co-ops, internships, summer professional experiences, and research experiences, both in the U.S. and abroad). The fraction of students participating in co-op programs and internship programs in the last six years is about 75%. The students who participate in co-op or internship programs meet the same graduation requirement as those who do not. Those who earn a co-op degree must work three non-consecutive terms

F. Program Locations

Almost all of the program courses are offered on-campus in Ames, IA. Each summer, a three credit Principles of Materials Science and Engineering course (equivalent to Mat E 215, the on-campus version) is taught on the campus of Brunel University in London by one of our faculty as part of a study abroad program. Many of our students participate in other study abroad programs and transfer credits for use in their ISU program.

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

There were no deficiencies, weaknesses, or unresolved concerns. There was one observation that the department was seeking to increase faculty strength in the polymers area. We have since added three faculty members, two tenure-track and one adjunct, with strength in the polymers area.

H. Joint Accreditation

This program is not jointly accredited and does not seek joint accreditation.

GENERAL CRITERIA

CRITERION 1. STUDENTS

A. Student Admissions

Admissions requirements are published in the ISU Catalog (Iowa State University Catalog: 2012-2013 Courses and Programs: http://catalog.iastate.edu/admissions/).

Undergraduate Admission Directly from High School

Admission decisions are made by admissions officers in accordance with the entrance requirements as set forth in the Iowa Administrative Code as well as the admission policies established by the Faculty Senate.

Students who seek admission must meet the following requirements and also any special requirements for the college or curriculum of their choice.

Applicants must submit an application for admission and the appropriate application fee (see www.admissions.iastate.edu for current application fee information). In addition applicants must have their secondary school provide an official transcript of their academic record, including cumulative grade point average, rank in class, and certification of graduation.

Applicants must also arrange to have their ACT or SAT scores reported to Iowa State directly from the testing agency. U.S. citizen and immigrant applicants who will not graduate from an approved U.S. high school and whose primary language is not English must meet university communication proficiency requirements. This can be accomplished by achieving satisfactory scores on the Test of English as a Foreign Language (TOEFL), the International English Language Testing System (IELTS), or the SAT. Contact the Office of Admissions for minimum score requirements for each examination.

Applicants may be required to submit additional information or data to support their applications.

A. Graduates of approved Iowa high schools who have the subject-matter background required by Iowa State University and who achieve a Regent Admission Index (RAI) score of at least 245 will be offered admission. Graduates of approved Iowa high schools who have the subject-matter background required by Iowa State University and who achieve less than a 245 RAI score will be considered for admission on an individual basis.

   The RAI score will be calculated for each applicant based on the following equation:

   (2 x ACT composite score)
   + (1 x percentile class rank)

+ (20 x high school GPA)
+ (5 x number of years of high school core courses completed)
= RAI Score

Note: For purposes of calculating the RAI, SAT scores will be converted to ACT composite equivalents; high school rank is expressed as a percentile with 99% as the top value; high school GPA is expressed on a 4-point scale; and number of high school courses completed in the core subject areas is expressed in terms of years or fractions of years of study.

Applicants from high schools that do not present all four of the factors required for calculation of the RAI score will be considered for admission on an individual basis.

Those applicants who are not offered unconditional admission will either be given the opportunity to enroll for a trial period during the preceding summer session or be denied admission.

B. Nonresidents of Iowa, including international students, may be held to higher academic standards, but must meet at least the same requirements as resident applicants.

C. Applicants who are graduates of non-approved high schools will be considered for admission in a manner similar to applicants from approved high schools, but additional emphasis will be given to scores earned on standardized examinations.

D. Applications may be considered from students who did not graduate with their high school classes. They will be required to submit all academic data to the extent that it exists and achieve scores on standardized examinations which will demonstrate that they are adequately prepared for academic study.

E. Students with satisfactory academic records may be admitted, on an individual basis, for part-time university study while enrolled in high school or during the summers prior to high school graduation.

F. Exceptional students may be admitted as full-time students before completing high school. Early admission is provided to serve persons whose academic achievement and personal and intellectual maturity clearly suggest readiness for college-level study.

High School Preparation

Graduation from an approved high school shall ordinarily precede entrance into Iowa State University. Students who wish to enter Iowa State University directly from high school (or transfer from another college or university with less than 24 semester hours of graded transferable college credit) must meet the level of academic performance described above and show evidence of the following high school preparation:

- English/Language Arts: Four years, emphasizing writing, speaking, and reading, as well as an understanding and appreciation of literature
- Mathematics: Three years, including one year each of algebra, geometry, and advanced algebra
- Science: Three years, including one year each of courses from two of the following fields: biology, chemistry, and physics
- Social Studies: Two years
- Students applying to the College of Engineering must have completed two years of a single foreign language.

Students who do not meet the high school course preparation requirements listed here, but who are otherwise well qualified, may be admitted after individual review of their applications.

Undergraduate Admission by Transfer from Other Educational Institutions

Students who seek admission must meet the following requirements and also any special requirements for the college and curriculum of their choice.

Applicants must submit an application for admission, and the appropriate application fee (see www.admissions.iastate.edu for current application fee information). Applicants must also request that each college they have attended send an official transcript of record to the Office of Admissions. Failure to provide transcripts from all colleges or universities attended may result in denial of the application or dismissal from the university. If less than 24 semester hours of graded transferable college credit is completed prior to entry at Iowa State University, applicants must also request that their official high school transcript and ACT or SAT scores be sent to the Office of Admissions. Other transfer applicants are encouraged to provide high school academic information. Students who do not do so may be asked to take course placement examinations during orientation.

U.S. citizen and immigrant applicants who have not graduated from an approved U.S. high school and whose primary language is not English must meet the university's English communication requirement. This can be accomplished by achieving satisfactory scores on the Test of English as a Foreign Language (TOEFL), the International English Language Testing System (IELTS) or the SAT. Contact the Office of Admissions for minimum score requirements for each examination.

A. Transfer applicants with a minimum of 24 semester hours of graded transferable credit from regionally accredited colleges or universities, who have achieved for all college work previously attempted the grade point average required by Iowa State for specific programs, will be admitted. A 2.00 grade point average (on a 4.00 grading scale) is the minimum transfer grade point average requirement. Some programs may require a transfer grade point average higher than this minimum. Higher academic standards may be required of students who are not residents of Iowa, including international students.

Applicants who have not maintained the grade point average required by Iowa State University for specific programs or who are under academic suspension from the last college attended generally will be denied admission.

B. In addition to meeting the minimum transfer grade point average requirement described above, applicants who have completed fewer than 24 semester hours of graded transferable college credit prior to their enrollment at Iowa State must also meet the admission requirements for students entering directly from high school.

C. Transfer applicants under disciplinary suspension will not be considered for admission until information concerning the reason for the suspension has been received from the college assigning the suspension. Applicants granted admission under these circumstances will be admitted on probation.

D. Transfer applicants from colleges and universities not regionally accredited will be considered for admission on an individual basis, taking into account all available academic information.

B. Evaluating Student Performance

The instructor in each course evaluates student performance by grading homework, quizzes, exams, reports, projects, presentations and class participation. All required courses and technical electives in the program are taken for grade (A-F, plus/minus). The only exceptions are a library course (1 credit) and Engr 101 Orientation to Engineering (R credit). Those two classes are graded on a pass/not-pass basis.

<u>Monitoring Student Progress</u>

The College of Engineering Academic Standards Committee is responsible for monitoring the academic progress of all undergraduate students in the college, based on policies and minimum requirements set by the Faculty Senate Committee on Academic Standards and Admissions and ratified by the Faculty Senate. The Committee is responsible for actions involving individual students with respect to placing students on academic probation, dismissing students from the university for unsatisfactory academic progress, and reinstating students who have been dismissed.

Students enrolled in the College of Engineering must satisfy both of the following requirements before enrolling in the professional courses (200-level and above) offered by departments in the Engineering College:

1. Completion of the Basic Program (Table 1-1) with a grade point average of 2.00 or better in the Basic Program courses.
2. A cumulative grade point average of 2.00 or better for all courses taken at Iowa State University.
3. The College of Engineering requires a grade of C or better for any transfer credit course that is applied to the Basic Program.

The following are the only exceptions to this rule:

a. Students who have completed all of their coursework while enrolled in the College of Engineering, but have not met the two basic program requirements, may enroll for not more than two semesters in 200-level or above courses offered by departments in the College of Engineering.
b. Students transferring to the College of Engineering from another college or university, or from a program outside this college, who have not met the two basic program requirements may also enroll for not more than two semesters in 200-level or above courses offered by departments in the College of Engineering. However, they may be granted an additional semester upon review by the college.
c. Iowa State students not pursuing an engineering degree may generally take engineering courses without restrictions provided they meet the prerequisites and space is available.
d. Only the first two semesters of 200-level and above engineering courses, taken at ISU while a student is not enrolled in the College of Engineering, can be applied toward an engineering degree

Table 1-1 College of Engineering Basic Program (27 credits total).

Credits	Cours(es)	Title(s)
4	Math 165	Calculus I
4	Math 166	Calculus II
3	Engl 150	Critical Thinking and Communication
3	Engl 250	Written, Oral, Visual and Electronic Composition
4	Chem 167 or 177	General Chemistry for Engineers or General Chemistry
3	Engr 160, AerE 160, CE 160, CprE 185, EE 185, SE 185, or IE 148	Engineering Problems with Computer Laboratory
5	Phys 221	Introduction to Classical Physics I
R	Engr 101	Engineering Orientation
1	Lib160	Library Instruction

Student progress is monitored through the degree audit system, overseen by advisors. For a complete description of the system, see Section F, Graduation Requirements. Prerequisites are managed and enforced through several mechanisms. The schedule of classes and course catalog clearly state course pre-requisites, and (when possible) the online registration system employs electronic restrictions so that students are prevented from registering from courses if they do not meet specific pre-requisites. However, not all pre-requisites are able to be enforced in this way, so it is essential that advisors monitor course drops throughout the semester, review the student's degree audit at registration time, and note failing grades on end-of-term grade reports. Advisors communicate with advisees regarding their ability to move on to other courses and bring forth any student appeals to pre-requisites to the MSE Undergraduate Curriculum Committee. The course instructor and/or MSE Undergraduate Curriculum Committee has jurisdiction over whether a course pre-requisite waiver would be warranted/granted.

C. Transfer Students and Transfer Courses

Transfer requirements are published in the ISU Catalog (Iowa State University Catalog: 2012-2013 Courses and Programs: http://catalog.iastate.edu/admissions/).

Iowa State University endorses the Joint Statement on Transfer and Award of Academic Credit approved by the American Council on Education (ACE) and the American Association of Collegiate Registrars and Admissions Officers (AACRAO). The current issue of Transfer Credit Practices of Designated Educational Institutions, published by AACRAO is an example of a reference used in determining transfer credit. The acceptance and use of transfer credit are subject to limitations in accordance with the educational policies of Iowa State University.

A. Students from regionally accredited colleges and universities. Credit earned at regionally accredited colleges and universities is acceptable for transfer, except for the following, which may not be accepted, or may be accepted to a limited extent:
    - Credit in courses determined by Iowa State University to be of a developmental, vocational, or technical nature
    - Credit in courses or programs in which the institution granting the credit is not directly involved.
    - No more than 65 semester or 97 quarter credits earned at two-year colleges can be applied to a bachelor’s degree from Iowa State University. While there is no limit to the number of credits that may be transferred from a four-year institution, the last 32 semester credits must be completed at Iowa State University.

B. Students from colleges and universities which have candidate status. Credit earned at colleges and universities which have become candidates for accreditation by a regional association is acceptable for transfer in a manner similar to that from regionally accredited colleges and universities if the credit is applicable to the bachelor's degree at Iowa State University. Credit earned at the junior and senior classification from an accredited two-year college which has received approval by a regional accrediting association for change to a four-year college may be accepted by Iowa State University.

C. Students from colleges and universities not regionally accredited. When students are admitted from colleges and universities not regionally accredited, they may validate portions or all of their transfer credit by satisfactory academic study at Iowa State, or by examination. The amount of transfer credit and the terms of the validation process will be specified at the time of admission. In determining the acceptability of transfer credit from private colleges in Iowa which do not have regional accreditation, the Regent Committee on Educational Relations, upon request from such institutions, evaluates the nature and standards of the academic program, faculty, student records, library, and laboratories. In determining the acceptability of transfer credit from colleges in states other than Iowa which are not regionally accredited, acceptance practices indicated in the current issue of Transfer Credit Practices of Designated Educational Institutions will be used as a guide. For institutions not listed in the publication, guidance is requested from the designated reporting institution of the appropriate state.

D. Students from foreign colleges and universities. Transfer credit from foreign educational institutions may be granted after a determination of the type of institution involved, its recognition by the educational authorities of the foreign country, and an evaluation of the content, level, and comparability of the study to courses and programs at Iowa State University. Credit may be granted in specific courses or assigned to general areas of study. Extensive use is made of professional journals and references which describe the educational systems and programs of individual countries.

Additional Transfer Credit Policies

A. Students with credit obtained during military service. Credit will be awarded for successful completion of technical or specialized schools attended while on active duty with the armed forces to the extent that the material is applicable toward degree requirements at Iowa State University. Application for such credit is made at the Office of Admissions, which follows many of the recommendations in the American Council on Education (ACE) publication A Guide to the Evaluation of Educational Experiences in the Armed Services.
B. Students with credit obtained through non-college sponsored instruction. Credit will be awarded for successful completion of learning acquired from participation in formal courses sponsored by associations, business, government, industry, and unions to the extent that the material is applicable toward degree requirements at Iowa State University. Application for such credit is made at the Office of Admissions, which follows many of the recommendations in the American Council on Education (ACE) publication The National Guide to Educational Credit for Training Programs.
C. Students with credit obtained through correspondence courses. Although Iowa State does not offer correspondence courses, college level courses taken by correspondence from accredited colleges or universities are acceptable for transfer at the undergraduate level if the courses taken are those that do not require laboratory study.
D. College Level Examination Program (CLEP). Iowa State University will award credit for each of the following 14 examinations: Financial Accounting, Principles of Accounting, American Government, Biology, Calculus, French Language, Humanities, Principles of Macroeconomics, Principles of Microeconomics, Natural Sciences, Introductory Psychology, Social Sciences and History, Introductory Sociology, Spanish Language. Application of CLEP credit to a degree program varies with the department, so students should consult with their department before they register for CLEP examinations. Additional information is available at www.admissions.iastate.edu/cbe/cbe_clep.php.
E. Students with test-out credit. Students who have earned credit at other colleges or universities through Advanced Placement (AP), College Level Examination Program (CLEP), or International Baccalaureate (IB) examinations may qualify for credit at Iowa State University. Scores from these examinations should be sent directly to the Office of Admissions; credit will be awarded provided the scores satisfy Iowa State's requirements.

Credit earned at another college through locally designed test-out examinations may transfer to Iowa State University if accompanied by at least 12 transferable semester credits earned through coursework taken at that institution.

<u>Articulation/Transfer Agreements (those that may apply to the program)</u>

D. Career-technical credit from Iowa public community colleges. Iowa State University will accept up to 16 semester (24 quarter) credits earned in career-technical courses where the sending Iowa public community college will accept such courses toward its associate of arts or associate in science degree. Certain career-technical courses at Iowa community colleges may be articulated to Iowa State University as academic credit. The credit hours earned in these articulated courses would transfer in addition to the 16 semester hour career-technical maximum. Please refer to the course equivalency guides on the Web (www.admissions.iastate.edu/equiv) or contact the Office of Admissions for more information.

E. AP and CLEP credit from Iowa public colleges and universities. Iowa State University has an agreement with the Iowa public colleges and universities which allows credit earned through AP and CLEP examinations to transfer directly to Iowa State University if accompanied by at least 12 transferable semester credits earned through coursework taken at the sending institution.

D. Advising and Career Guidance

Career guidance to all engineering students is accomplished through a partnership between the department and Engineering Career Services (ECS). Faculty and academic advisors work with ECS to develop career self-management skills in a variety of curricular and extra-curricular activities. Career advising begins the freshman year and continues through graduation.

On the curricular side, departmental seminar classes have a significant emphasis on career skills development, and professional practicing engineers are often invited into the classroom to talk about career skills, as well as, technical subjects. The development of professional competencies, such as communication, teamwork, project management, initiative, continuous learning, and ethics in engineering are included in capstone and other design courses, and are reinforced to students during the formative assessment process of our experiential education program. As part of our college's continuous improvement processes, the student and supervisor assessment data from the experiential education program is analyzed to extract an understanding of the expectations for student outcomes and performance as practicing engineers.

On the extra-curricular side, ECS offers seminars and individual counseling to students on career topics and tools such as: self-marketing, leadership development, resume & interview preparation, job search strategies, career interest and skill matching, networking and advanced communication skills. Additionally, leadership and project management development is a significant objective of student organization officer and learning community peer mentor training.

In the Materials Science and Engineering Department, each student is assigned a professional academic advisor who serves as an important resource to mentor and guide students through an academic path tailored to their specific educational and career goals. The advisor needs to be knowledgeable about university, college, and departmental policies, course offerings, programs, and procedures. Students are encouraged to develop strong relationships with their advisor so that the advice provided is timely and pertinent to their individual situation. Advisors maintain essential relationships with various university staff and faculty who serve as a support network for the students to navigate successfully to degree completion.

For students who enter ISU as declared Materials Engineering majors, advising begins during summer orientation where they meet their academic advisor to plan their first semester classes. At this time, the advisor gains knowledge of the student's initial goals and offers information related to options and opportunities within the department (e.g. internships, Iowa State University Honors Program, international study, hourly work opportunities as an undergraduate research assistant or course grader, available scholarships, and the concurrent BS/MS program). Each student is supplied with a copy of the MSE Undergraduate Student Handbook, and the four-year degree plan is reviewed (see the four-year plan in the departmental documents notebook).

Each fall, all new first year students are enrolled in an engineering orientation class (ENGR 101 for MSE students) taught by the academic advisors. Topics covered through this course include many university, college, and departmental rules and policies that are important for each student to understand. This class also reviews OPAL (the college-based competency assessment tool), and all students are assigned to complete the OPAL survey to collect data regarding the personal assessment of these first year students. Faculty participation in ENGR 101 offers the students additional information about the field of Materials Science & Engineering, answers some preliminary questions regarding career and graduate school options, and helps facilitate faculty-student interaction. This course also aims to ease the transition of the students from high school academics to their college life. Modules related to stress management, time management, study skills, and career development, with presentations by related campus resources, provide a framework for students to create a successful academic plan and routine.

Each semester, students have individual meetings with their advisors, as needed, and are (at minimum) required to meet immediately prior to their registration date for the upcoming term. During this pre-registration meeting, advisors review course planning for the next semester and evaluate the students' progress toward graduation with the help of the degree audit. Also, throughout the semester, advisors help students with such things as:

- making schedule changes (adds, drops, section transfers),
- assessing transfer credits,
- monitoring academic progress issues,
- exploring and planning for study abroad opportunities,
- exploring and planning for work experience opportunities,
- managing academic and personal concerns,
- referring students to other university support services when appropriate, and
- explaining and managing policies and procedures to ensure the student meets all graduation requirements at the department, college, and university levels,

- organizing and operating the peer mentoring system and the learning community.

Career guidance is an essential part of the advising experience, and advisors utilize the resources of Engineering Career Services for information related to the job posting database maintained by the College of Engineering, career fairs, programming regarding resumes, interviewing, and negotiating job offers. Advisors encourage students to think about their professional development in every aspect of their college academic and extracurricular life and offer tailored guidance based on the individual student's goals.

Advisors in our department as especially attentive to a student's interest and potential for graduate school and recommend that students begin preparing themselves as early as possible. Since 30-40% of our students do enroll in graduate programs, it is important for advisors to identify and counsel these students appropriately regarding the application timeline and make referrals to faculty who are able to mentor students regarding the process, research interests, and selection of schools.
Quality control in advising is achieved through feedback collected each spring semester through advisor evaluations and yearly in senior exit interviews. Advisors meet regularly to discuss common concerns and emerging trends related to advising. Advisors are members of the MSE Undergraduate Curriculum Committee and participate in college-level committees related general advising, learning communities, and internships.

E. Work in Lieu of Courses

Iowa State University participates in the Advanced Placement program of the College Board. For specific equivalencies related to achievement of minimum scores to be awarded ISU credit, see the following website: http://www.admissions.iastate.edu/cbe/ap.php.

Credit for College Board subject examinations of the College-Level Examination Program (CLEP) may be granted for a score above the 67th percentile. Subject examinations are considered equivalent to specific courses at Iowa State University. For specific equivalencies, see the chart at the following site: http://www.admissions.iastate.edu/cbe/clep.php

Students may be granted credit through the International Baccalaureate Program based on the achievement of specific minimum scores on the subject exams taken at the end of those courses in their high school. Scores and their ISU credit equivalents can be viewed at the following site: http://www.admissions.iastate.edu/cbe/ib.php

Credit earned by examination is not used in computing grade point averages. However, credit earned does become part of your official record and may be applied toward graduation requirements at Iowa State University.

Dual enrollment credit earned from another institution while a student is enrolled in high school, before attending Iowa State, may be used similarly to transfer credit. A student must earn a grade of "C" or higher for a course to be considered to meet a Mat E degree requirement. No courses labeled career/technical/vocational by the Iowa State Office of Admission will be accepted to meet a Mat E degree requirement unless the course is evaluated by faculty at Iowa State who deem it acceptable to the program.

Life experience and/or military experience do not translate into awarding of credits at Iowa State. However, either or both of these may be evaluated to potentially meet the university-level U.S. Diversity or International Perspectives requirement. The International Perspective requirement shall be waived for U.S. military veterans who have completed at least 3 months of service stationed outside of the United States. (Approved by the Faculty Senate Curriculum Committee, Academic Standards and Admissions Committee, Academic Affairs Council and Executive Board of the Faculty Senate.)

Requests for waivers of the U.S. Diversity or International Perspective requirements will ordinarily be based on aspects of the student's personal experience that the student believes have enabled him or her to meet the intent of the requirement. In the case of the U.S. diversity requirement, membership in a minority group will not, in itself, serve as sufficient grounds for a waiver. International students - defined as those students whose citizenship status is coded N (for nonimmigrant) or R (for refugee or asylee) on their official university record - are exempted from the international perspectives requirement because these students, by living and studying in a country other than their home country for an extended period, are meeting the objectives of that requirement in what is perhaps the ideal way. If a student supports a waiver request with evidence of personal experience or activities with multicultural or international aspects, these experiences or activities must be of an academic nature although not necessarily credit-bearing.

F. Graduation Requirements

The name of the degree awarded is Bachelor of Science in Materials Engineering. The graduation requirements for the program are as follows. The graduation requirements for the Bachelor of Science in Materials Engineering are listed in a visual four-year curriculum plan in Table 5-3 and are also outlined on a student's ISU degree audit. Briefly, they are the 27 credit Basic Program shown in Table 1-1; 15 General Education electives, including a communication requirement; 18 credits in specified math and physical science courses; 50 credits of materials engineering courses; 6 credits of engineering mechanics; 9 technical elective credits; and 3 free elective credits.

The University requires all students to have at least a 2.00 GPA in order to graduate. Graduation requirements are documented through an electronic degree audit (http://www.registrar.iastate.edu/dars/). The degree audit is an individualized report that reflects a student's academic progress toward a specified degree. It compares the student's course work (both from ISU and transfer work from other institutions) with the academic degree program, and then prepares a report (the degree audit) which details the student's progress toward meeting the requirements of a specified degree.

The degree audit: provides an ability to generate data for reports that students and advisers may use for course planning; allows authorized personnel to enter course adjustments for students who may have courses that need to be moved to other requirements; provides timely information of student progress on the web through Access Plus; and improves consistency in advising appointments and graduation clearance. Degree audits are intended to assist students in determining their academic progress at ISU. Every effort is made to ensure accuracy, however a final responsibility for meeting graduation requirements reside with the student. Students are encouraged to check with their advisers on a regular basis as they progress towards their degree.

Degree audits are available to students 24/7 through Access Plus, the university's online system for accessing your important and confidential university information and web applications, since 1995. Advisors can access student degree audits through Access Plus and also receive printed copies each semester.

Degree requirements are reviewed by the Register after the first week of classes during the term the student intends to graduate. The student and adviser will be notified of the student's graduation status--by midterm. If the degree audit shows no problems, a letter is forwarded to the student and adviser stating that upon satisfactory completion of the courses included on the current schedule, the academic requirements will be complete. If the degree audit needs further clarification and approval from the adviser and college office, a checklist will be forwarded to the student and adviser identifying the problem(s) that must be resolved in order for the student to meet the department's graduation requirements.

The academic advisor reviews the degree audit with the student as he/she matriculates through the program to ensure that all requirements for graduation are being met. If there are any exceptions to the curriculum they are reviewed by the department and/or advisor; any changes to the student's degree audit is submitted to the college classification office for processing on the student's degree audit. The University Graduation evaluator will review submitted applications for graduation and if any issues are identified these are shared with the college classification office. The college classification office then works with the student's advisor to address any remaining issues related to graduation.

G. Transcripts of Recent Graduates

The program has provided transcripts from some of the most recent graduates, via the Dean's office, to the visiting team along with any needed explanation of how the transcripts are to be interpreted. Students take two of four possible specializations. The official transcript of a graduate will list the degree conferred (B.S. Materials Engineering) along with the date of graduation (example: 05-05-2012). Any secondary majors or degrees will also be listed. The selected option (specialization choices) is not reflected on the transcript, but it may be referenced by viewing the student's degree audit, which lists specific requirements and how they were met by courses taken.

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

Program Educational Objectives

The program educational objectives for the Materials Engineering program have been developed through ongoing conversations with various constituencies. These are periodically reviewed and adapted to the changing environment in which our students are expected to practice as engineers and scientists. The objectives are published in our undergraduate student handbook, on the MSE web page (under Assessment) and in other promotional documentation for the department. The objectives are also discussed with students during summer orientation and during the Engr. 101 Freshmen Engineering Orientation course.

In this section, excerpts from the departmental mission statement are given and linked to the program objectives. These objectives are closely tied with those of the university and the college. For that reason, excerpts from the strategic plans and mission statements of the University and the College are frequently referred to (the entire documents: the Strategic Plans and Mission Statements will be available at the time of the visit).

A. Mission Statements

University Mission Statement:

The University Mission Statement as published in the 2010-2015 Strategic Plan has an overarching statement that is expanded upon to address the three themes of the land grant ideal. Here is that which addresses the education component:

ISU Mission: Create, share, and apply knowledge to make Iowa and the world a better place.

• To share knowledge, Iowa State's faculty, staff, and students must be able to communicate with and learn from diverse populations. The University must maintain a strong focus on student success and provide exceptional undergraduate, graduate, professional, and outreach programs that prepare students and citizens for leadership and success.

In order to address this mission, the stated priorities are given as follows:
Iowa State will be a magnet for attracting outstanding students who seek an education that prepares them to make a difference in the world.
Goals:
• Recruit, support, retain, and graduate a diverse group of outstanding undergraduate, graduate, and professional students dedicated to making a difference in the world.
• Provide accessible residential and distance educational programs that build on Iowa State's strengths and excellence in science and technology integrated with design, business, education, arts, humanities, and social sciences.
• Provide a high quality student life that engages and challenges students to collaboratively learn, grow, and succeed as resilient global citizens and involved alumni.

College Mission Statement:

The 2011-2016 COE Strategic Plan has as its stated mission:
To be engineers who make a difference.

The related vision is to be the premier engineering program among public universities known for commitment to providing a high-quality practical education that enables students to meet the grand challenges of the 21st century.

MSE Department Mission Statement:
The MSE Department at Iowa State University is committed to being a recognized center of knowledge, experience, ingenuity, and leadership that is unique in scope and unsurpassed in dedication to its students and other constituents. Through discovery, innovation, education, and engagement, we aim to improve the human condition and prospects for sustainable prosperity in Iowa, the United States, and beyond. So dedicated, we accept and embrace the following responsibilities as being central to our collective mission. The specific goals are addressed within the context of our educational objectives in the following sections.

B. Program Educational Objectives:

The Materials Science and Engineering Department embraces the commitment of the ISU College of Engineering to education focused on learning-based, practice-oriented, active involvement of students. With its smaller student body, extensive laboratory experiences, and ample opportunities to participate in international programs, research projects and co-op/internship programs, the Department is ideally situated to realize this vision.

The materials engineering curriculum builds on strong basic science fundamentals. The program offers four areas of specialization: ceramic, electronic, metallic and polymeric materials. Each student has the option to choose any two (or more) areas of specialization providing the flexibility for each student to design his/her area of expertise. Additionally, the department offers a “proposal-based specialization” that allows highly qualified students even more flexibility to define a program consistent with individual career goals.

Published Educational Objectives

Within the scope of the MSE mission, the objectives of the Materials Engineering Program are to produce graduates who

A. practice materials engineering in a broad range of industries including materials production, semiconductors, medical/environmental, consumer products, and transportation products.
B. engage in advanced study in materials and related or complementary fields.

In 2011 our program, along with all others in our college, submitted an advance rough draft of certain sections of this self-study to an experienced ABET program evaluator and team leader hired to consult on out continuous improvement and assessment programs. His advice was to change our PEOs to the two listed above. He advised us that the four previous objectives we specified sounded too much like outcomes. Our faculty reviewed his recommendation and agreed. In fact, the new objectives were seen as simplified, yet consistent, restatements of the previous ones.

The previous objectives were;

Within the scope of the MSE mission, the objectives of the Materials Engineering Program are to produce graduates who

- practice materials engineering in a broad range of industries including materials production, semiconductors, medical/environmental, consumer products, and transportation products.
- respond to environmental, social, political, ethical, and economic constraints to improve the quality of life in Iowa and the world
- work independently and in teams and are proficient in written, oral, and graphical communication
- engage in lifelong learning in response to the rapidly expanding knowledge base and changing environment of our world
- engage in advanced study in materials and related or complementary fields

These objectives had been in place since 2000.

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

These objectives are consistent with and complementary to those of the engineering college and the university. Here, each departmental objective is given with the appropriate university and college excerpts.

A. practice materials engineering in a broad range of industries including materials production, semiconductors, medical/environmental, consumer products, and transportation products.

Excerpted from the MSE Department current strategic plan:

Deliver to our undergraduate students a forward-focused education of the highest possible caliber. A top-flight education of our undergraduates, grounded in fundamental science and mathematics but with a focus on future technological demands and applications, will provide our students with the skills necessary to compete, thrive, and contribute to industry and society. Moreover, by broadening the scope of technical skills possessed by Materials Engineering graduates, we aim to expand the role of (and demand for) Materials Engineers in technology, industry, and research.

Excerpted from the College Strategy statement in the current strategic plan:

21st century learning. We are committed to providing students with value and best-in-class education by leveraging new pedagogy, diverse perspectives, and time- and distance-shifted delivery. By viewing the engineering profession in social context, our students will be prepared to use their education and creativity to improve lives and livelihoods. Our curriculum will reach beyond the classroom and empower students with practical learning opportunities, research projects, team design, and international experiences as important aspects of our educational brand. We will strengthen programs in which we already hold comparative advantage—areas as renowned as biorenewables, **materials,** and virtual reality—and invest in the initiative of our faculty to move emerging programs to maturity and strength.

Excerpted from the University Mission statement:

To share knowledge: Iowa State's faculty, staff, and students must be able to communicate with and learn from diverse populations. The University must maintain a strong focus on student success and provide exceptional undergraduate, graduate, professional, and outreach programs that prepare students and citizens for leadership and success.

Excerpted from the University Priorities statement:

Recruit, support, retain, and graduate a diverse group of outstanding undergraduate, graduate, and professional students dedicated to making a difference in the world

B. engage in advanced study in materials and related or complementary fields.

Excerpted from the College Strategy statement:

We are committed to developing engineering talent across the entire educational value chain, extending from pre-collegiate experiences to lifelong learning opportunities for practitioners.

D. Program Constituencies

The primary constituencies of this program are students, employers, and faculty. Other important constituencies include alumni, community colleges from which we admit transfer students, the parents of students, the Board of Regents, and universities to which we send graduates for further study. The effect on all of these constituencies is considered with each programmatic change and improvement. Students, faculty, employers, and alumni are directly involved in decision making by participation in faculty retreats and industrial advisory board meetings. Community college communication and coordination occurs through the Engineering College articulation efforts. Parents are informed of departmental activities through the mailing of electronic newsletters each year. The general public is informed of our expertise and program through a variety of outreach activities and news releases. Our award winning Materials Advantage Student group is extremely active in reaching out to the community. Two external reviews of the department was conducted in spring of 2010, one by our Industrial Advisory Council and one by a special academic review panel. The results will be discussed in section 4 of this report. The Office of the Provost conducts periodic external reviews of each department.

The MSE Industrial Advisory Board (MSEIAB) – formerly called the Industrial Advisory Council - plays a key role in guiding the department. The MSEIAB was established in the fall of 1996, at which time it was charged with the following:

A. Advise the department of industry's expectations for engineering graduates in the 21st century.
B. Assist the department in curriculum decisions to achieve item A
C. Communicate MSE department needs and priorities to the College of Engineering Administration.
D. Assist the department in strengthening and expanding long-term industrial partnerships such as: internships, co-op programs for

undergraduate students, employment opportunities for graduating engineers, industrial experience for MSE faculty, academic experience for the practicing engineer in industry, and research projects of mutual interest

E. Guide the department in fund raising activities.

The board membership exhibits a great deal of diversity in seniority (early career engineers to deputy directors of a national laboratory in geographical representation (Iowa to California), in industry (metals manufacturing to microelectronics), background (discipline, educational level, schools), as well as diversity in gender. The unifying thread in the board membership is that all IAB members are genuinely interested in our programs and in the future of the department. The board membership is on a staggered rotating basis with 3 year appointments with a maximum of two consecutive terms.

During MSE IAB meetings, it is common to have breakout groups by specialization. These board members have provided valuable guidance to the MSE department.

E. Process for Revision of the Program Educational Objectives

Figure 2-1 shows how the program objectives are determined and evaluated for continuous program improvement. The 2011 consultant's advice on our PEOs is considered as part of the block labeled "review by constituencies" since the faculty reviewed the suggestions before they were implemented. The objectives were written and published with input from all primary constituencies including faculty, students, industrial partners, and alumni. The performance criteria are set with respect to what is being measured. Data are collected from various sources including alumni surveys, statistics on graduate job offers, and graduate school placement. The collected data are processed and analyzed at the end of the academic year by the curriculum committee, at spring industrial advisory board meetings, and at faculty retreats, and changes are proposed, discussed, and considered for implementation. In the case where objectives are not being met at the desired level, there are at least three considerations: the adequacy and appropriateness of the program to meet its objectives, the appropriateness of the program objectives statement, and the measurement instrument itself. Each is considered, and appropriate action taken as indicated in the flowchart. If it is determined that the program is at fault, the program outcomes are carefully examined for deficiencies, and corrective action is taken.

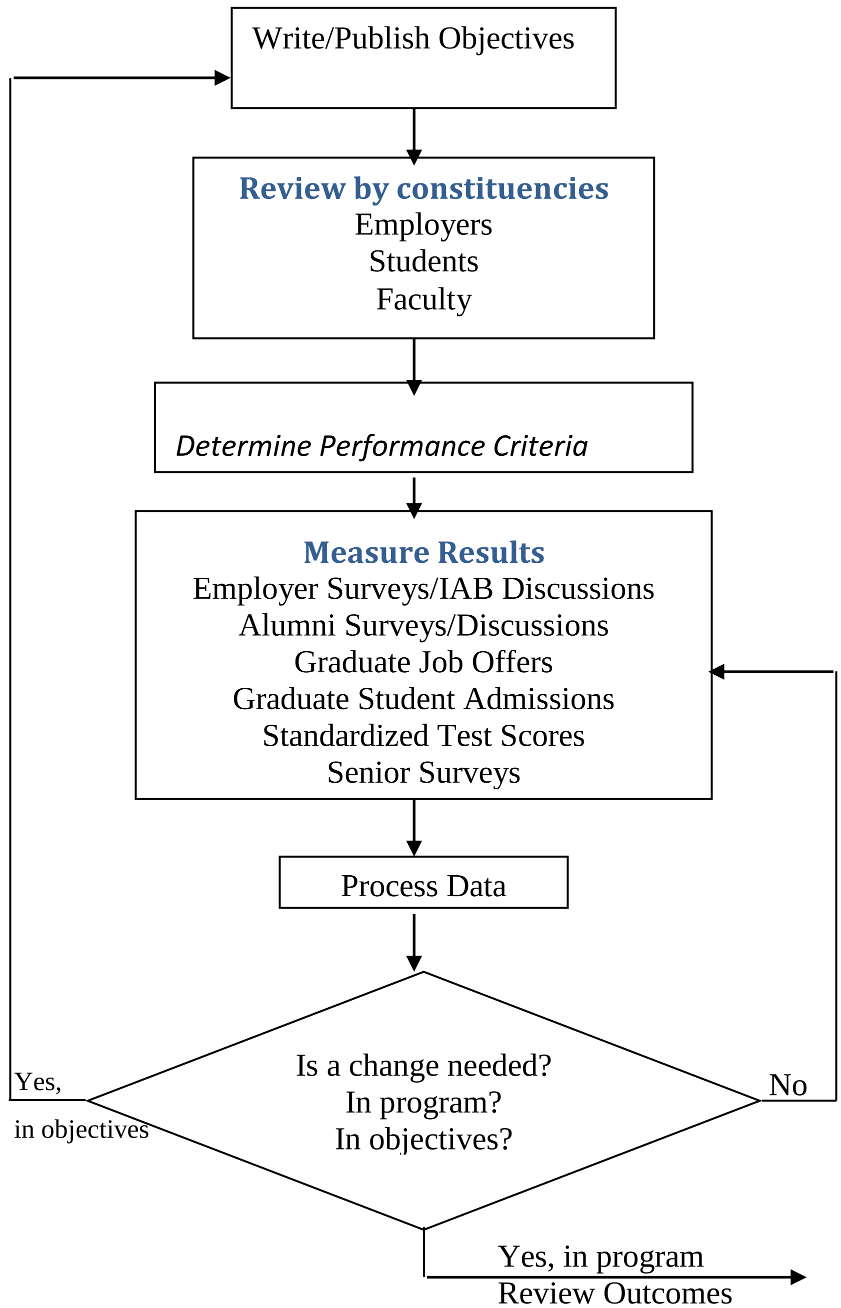


Figure 2-1 Process for Review and Change of the Program Educational Objectives

CRITERION 3. STUDENT OUTCOMES

A. Student Outcomes

Student outcomes for materials engineers at Iowa State University are divided into three categories. Outcomes a-k are applicable to any ABET-accredited engineering program and are adopted directly as stated by ABET as the general criteria. Outcomes l-o apply to any materials engineer and are directly adopted from ABET's program criteria. Finally, outcomes p-r are those which are specific to students graduating with a Materials Engineering degree from Iowa State University. These student outcomes are documented in the Undergraduate Student Handbook which is given in hardcopy form to each student when they join the department, as well as being available electronically on the department web site. On the department web site is a link to "assessment" (first "about," then "The Department") and the program educational objectives and student outcomes are shown there. The student outcomes and program educational objectives are also printed and displayed on various bulletin boards within the department. Since we assess progress towards achieving the student outcomes as part of every materials engineering course assessment, the outcomes are seen by students at the end of each course; therefore, several times each semester for each student majoring in Materials Engineering. Many course instructors also present these intended outcomes explicitly at the beginning of a particular course.

The Materials Engineering degree student outcomes are;

Graduates in Materials Engineering will have demonstrated the following at the time of graduation:

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of the need for and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
l. an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
m. an integrated understanding of the scientific and engineering principles underlying the four major elements of the field (structure, properties, processing, & performance)
n. an ability to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems

o. an ability to utilize experimental, statistical, and computational methods consistent with the goals of the program.
p. mastery of creative, independent problem solving skills, under time and resource constraints, in a broad range of materials-related applications critical to the success of the final product.
q. experience in materials engineering practice through co-ops or internships in industry, national laboratories, or other funded research work.
r. hands-on skills with a broad range of modern materials processing and characterization equipment and methods, with special in-depth concentration in two student-selected areas from among ceramic, electronic, metallic, and polymeric materials

B. Relationship of Student Outcomes to Program Educational Objectives

It is critical to demonstrate that achieving student outcomes prepares students to meet program educational objectives. Table 3-1 shows this relationship and should be read, for example "In order to practice materials engineering in a broad range of …, a student must demonstrate an ability to apply math, science, and engineering…." A case could be argued for situations where many of the student outcomes contribute to *each* program educational objective, however, only those outcomes most critical to the achievement of a particular objective are listed. Program Educational Objectives are repeated below for reference.

Program Educational Objectives

Within the scope of the MSE mission, the objectives of the Materials Engineering Program are to produce graduates who:

A. practice materials engineering in a broad range of industries including materials production, semiconductors, medical/environmental, consumer products, and transportation products.
B. engage in advanced study in materials and related or complementary fields.

TABLE 3-1: Relationship between Program Educational Objectives and Student Outcomes

Objective		Program Outcome
In order to…		*a student must demonstrate:*
A, B	a.	an ability to apply knowledge of mathematics, science, and engineering
A, B	b.	an ability to design and conduct experiments, as well as to analyze and interpret data
A, B	c.	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
A	d.	an ability to function on multi-disciplinary teams
A, B	e	an ability to identify, formulate, and solve engineering problems
A	f.	an understanding of professional and ethical responsibility
A, B	g.	an ability to communicate effectively
A	h.	the broad education necessary to understand the impact of

		engineering solutions in a global, economic, environmental, and social context
A, B	i.	a recognition of the need for and an ability to engage in life-long learning
A	j.	a knowledge of contemporary issues
A, B	k.	an ability to use modern engineering tools necessary for engineering practice
A, B	l.	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
A, B	m.	an integrated understanding (structure, properties, processing, & performance)
A, B	n.	an ability to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems
A, B	o.	an ability to utilize experimental, statistical, and computational methods consistent with the program educational objectives
A, B	p.	mastery of creative, independent problem solving skills, under time and resource constraints in a broad range of materials-related applications critical to the success of the final product
A	q.	experience in materials engineering practice through co-ops or internships in industry, national laboratories, or other funded research work
A, B	r.	hands-on skills with a broad range of modern materials processing and characterization equipment and methods, with special in-depth concentration in two student-selected areas from among ceramic, electronic, metallic, and polymeric materials

Evidence of achievement of both the student outcomes and the program educational objectives will be presented in the next section.

CRITERION 4. CONTINUOUS IMPROVEMENT

A. Program Educational Objectives

Table 4-1 summarizes the assessment and evaluation of the program educational objectives. Greater detail will be given in the Continuous Improvement section about the results of the assessments and evaluations and how that has resulted in changes to our program.

Table 4-1: Assessment/Evaluation of Program Educational Objectives

Type of Assessment	Frequency of Assessment	Level of Attainment	Summary of Evaluation	Results Documented /Maintained
Alumni Surveys	Every 5 Years	Subjective data analyzed by Cur Com	Results show alumni value co-ops, international experience, undergraduate research, and participate in lifelong learning	ECS collects data/program maintains
Alumni OPAL Questionnaire	Every 5 Years	Objective data > 80% achieved	Objective data shows growth since graduation (See Figure C4.3)	ECS collects data/program maintains
Employer and Student Intern OPAL Surveys	Every semester Intern/co-op	Validates Direct vs. Indirect Assessment	Objective data shows supervisors' measures vs. student self-measures (See Figure C4.1)	ECS collects data/program maintains
Industrial Advisory Board	Once per year	Suggestions for study, Report at next meeting	Almost all suggestions from IAB enacted	Reports of IAB Meetings
Outcomes as Preparation	Continuous	Varies (See Outcomes Section)	Achievement of Outcomes Prepares Students for Attaining Objectives	See Outcomes Section

B. Student Outcomes

Table 4-2 summarizes the assessment and evaluation of the student outcomes. Greater detail will be given in the Continuous Improvement section about the results of the assessments and evaluations and how that has resulted in changes to our program.

Table 4-2: Assessment/Evaluation of Student Outcomes

Type of Assessment	Frequency of Assessment	Level of Attainment	Summary of Evaluation	Results Documented /Maintained
Curricular Measures				
Course Performance	Every Semester	Grades/ Instructor reflection	Student course performance Brought changes in instructor Assignments in some courses	Course portfolios
Course Self-Evaluations	Every Semester	Objective data > 3.0 Comments reviewed	Several outcomes required attention – some were deemed not appropriate for course, others brought changes to course	Cur Com

Transcripts/ Degree Audits	Every Semester	Degree Audits every semester	New degree audit system has Brought some challenges to Get to function properly, but Student information is working well	Advisors
Professional Practice (Design)	Spring Semester	Student ratings of course And instructor	Several changes to senior Professional practice (design) Documented later in detail	Course Portfolio/ Cur Com
Supporting Programs & Activities				
Employer and Student Intern OPAL Surveys	Every semester Intern/co-op	Objective data > 80% achieved	Validates Direct vs. Indirect Assessment (See Figure C4.3)	ECS collects data/program maintains
International Experience Evaluations	Every Semester	Course grades/ transfers	Brunel program working well New Prof in Charge is MSE And new programs show promise	Advisors/ Student Database
Honors POS	Continuous	Progress/ Honors Content	Half our students enter in Honors. Fewer remain in Honors to graduation	Honors Advisor
Professional Societies Student Organizations	Continuous	Awards/ Percent participation	Material Advantage Outstanding Chapter in World 7 consecutive years	Material Advantage
Academic/National Lab Research	Continuous	Participation/ UG Research Presentations	More than 40 % work in Research as undergraduates	Student Database
Summative Data				
Senior Exit Surveys	Every Semester	Subjective discussed By Cur Com	Many comments repeat Items addressed from student Feedback sessions	ECS collects data/program maintains
Placement Data	Every Semester	Percent Employed/ Grad School	92% placed in 06-10, with a dip in 09-10 to 78%	ECS collects data/program maintains
Alumni Surveys/ OPAL	Every 5 years	Objective data > 80% achieved Subjective discussed By Cur Com	Shows improvement from graduation to current (3-5 years afterward)	ECS collects data/program maintains
Student Feedback Sessions	As Needed/ Requested	Comments/Suggestions to appropriate parties	Pre-reqs changed for more flexibility Mat E 201 offered Voluntary Matlab course Added open lab space	Reports Cur Com
Industrial Advisory Board	Once per year	Program Review about once/year	Most recent review Suggestions enacted	Reports
External Academic Review Panel	As requested (most recent Spring 2010)	Program Review	Studied number of Mat E Credits, number of Tech Elec credits – normed nationally	Report
Internal Faculty Review Committee	As requested (most recent 2010-2011)	Reviewed both IAB & Ext Acad Panel Reports/ Recommend actions	Number credits appropriate Technical electives OK New rare earths, magnetics courses	Report

C. Continuous Improvement

The Program Educational Objectives are measured in several ways as shown in Table 4-1. The Alumni survey has been used in its current form, which includes the same assessment as has been professionally developed for our experiential learning courses, twice; once in 2005 and again in 2011. Since collecting a direct measure (having their job supervisor rate the alum using our assessment tool) is difficult, if not impossible, this assessment is an indirect measure where the alum self-rates his/her competencies in certain tasks. As will be demonstrated later in this section, using the same assessment tool for our alumni as we use for our co-op/intern experience students while still undergraduates allows us to calibrate student responses against a true direct measure, supervisors of our interns, who assess our students using the same tool. A complete description of the assessment tool, its validation, and results follows later in this chapter, along with the results of our alumni assessment.

Another measure of achieving the Program Educational Objectives is the discussions that take place with our Industrial Advisory Board (until a reformulation in 2009, it was known as the Industrial Advisory Council) once a year. Since 2009, there have been both teleconference meetings and once-a-year IAB on-campus meetings. Topics vary for the IAB and only those meetings focused on the undergraduate program will be discussed in this document. In 2009 the IAB was reconstituted to have more of an industrial focus. In the past this group contained both industrial and academic members. It was felt that the focus needed was difficult to achieve with disparate members. Now the IAB consists only of industrial members and the academic review is taken care of by periodic reviews performed by a panel of external academics. In the spring of 2010 we had not only a review of our undergraduate program by our IAB, but an external panel of academic reviewers visited campus to review our department, including the undergraduate program. Afterward, an internal committee was appointed to study both reviews and make recommendations to our faculty.

The fall 2007 Industrial Advisory Council Meeting

At this meeting of the IAC the undergraduate curriculum was reviewed. The idea of increasing the core fundamentals courses, and therefore decreasing the specializations from four to three courses, was proposed and discussed. From the perspective of these employers, it was felt that their future employees would benefit more from a greater fundamental coverage of all materials rather than greater depth in one type of material. Since this speaks directly to both the Program Educational Objectives and the Student Outcomes, the faculty studied this idea and enacted it in the fall of 2009. Specific changes to the core and specializations courses are detailed later in this section. Since, at that time, over 40 % of our graduates were going onto graduate school, it was felt that a method was needed to better prepare them for that future. The idea for a proposal-based specialization, also discussed later in this section, grew out of this discussion. Flexibility for all students is enhanced by allowing a student who plans to attend graduate school choose a materials-related specialization (that might include modern physics, mathematical modeling, higher level materials courses as an undergraduate, etc.) that better prepares them for advanced study, while allowing industry-bound students to choose their own path.

The spring 2010 External Academic Review Panel

This panel included David Clarke of Harvard University, Anthony Rollett of Carnegie Mellon University, Tresa Pollock of the University of California – Santa Barbara (Chair), and Peter Voorhees of Northwestern University. A summary of their findings is

- The review panel raves about our undergraduate program "*A hallmark of the department is the strength of its undergraduate program.*"
  - Quality of undergrads
  - Dedication of faculty
  - Quality of facilities
  - Extraordinary sense of community
- *"appears to the committee to be an excessive MSE course load"*
  - too many credits are required in MSE courses resulting in
    - Increased teaching load
    - Very little flexibility in taking courses elsewhere in the college
  - Recommendation: "*the committee recommends a comprehensive re-evaluation, benchmarked against peer institutions*"

The spring 2010 Industrial Advisory Board

After a couple of years of inactivity, the IAC was reconstituted into the IAB and the spring of 2010 was the first face-to-face meeting of that group to focus on the undergraduate curriculum. A summary of their findings is

- The IAB compliments the strength of the program
- States that there is "*a gap in relating (structure and properties) to materials processing and performance."*
- Specific Recommendations:
  - *Suggest making MAT E 443, a requirement for all undergraduates*
  - *Develop a 400 level class on Rare Earth Materials*
  - *Remove EM 324 from the curriculum as a requirement*
  - *Re-institute Magnetic Materials course*
  - *Re-scope Mat E 413 and 414 courses*
  - *Materials Processing courses lacking*

The Faculty Committee study2010-11 and Recommendations/Actions

In order to address the Academic Review Panel's finding of too many required MSE credits the faculty committee followed the recommendation to do a comprehensive study of the highly ranked materials programs in the nation and benchmark our program against those. Ten programs were selected for study. They are the materials programs at the University of Wisconsin-Madison, Northwestern University, the University of Florida, Ohio State University, Penn State, Purdue University, the University of Pennsylvania, Georgia Tech, the University of Illinois at Urbana-Champaign, and the University of California-Berkeley. The committee looked at the required MSE courses, specialization courses if any, technical electives, and total credits required. The committee also investigated each of the recommendations of the IAB.

Recommendations/Actions

It was found that the highly ranked programs studied are very similar to Iowa State's. Specifically,

- The total MSE required credits are relatively constant
  - Mean: 56, Range: 45-63 Most in 50-55 range ISU requires 50
- Common to (almost) all programs:
  - Intro. to Materials
  - Thermodynamics
  - Kinetics
  - Phase Transformations
  - Materials Characterization
  - Mechanical Behavior
  - Electrical/Electronic Behavior
  - Design/Professional Practice.
- MSE coded technical electives: Similar to our specialization courses
  - Minimum 6, maximum 21 credits, ISU's two specializations total 18 credits

Regarding other questions and specific recommendations from either set of reviewers:

- Are there courses that are obsolete?
  - The answer is no.
- Should we add new topics to the curriculum?
  - A number of programs are offering courses in nanomaterials as well as processing at the undergraduate level. We might offer new courses or emphasize these topics in existing courses.
- Should there be a required "Computational Materials Science course?"
  - With the exception of OSU, this did not come out as a strong indicator.
- Should we introduce additional courses as suggested by IAB?
  - Suggest making Mat E 443 a requirement for all undergrads: the increased fundamentals (from 5 to 8 credits) in Mat E 215/215L/216 should meet this need.
- Develop a 400 level class on Rare Earth Materials
  - A Rare earth course was offered in Spring 2012.
- Remove EM 324 from the curriculum as a requirement
  - This question was brought to the MSE Curriculum Committee and it believes this course should not be removed since the amount of overlap with Mat E 418 has been reduced in recent years and student input said some overlap, especially from a materials point of view, was good.
- Re-institute Magnetic Materials course
  - Magnetic Materials course was re-instated in the fall of 2011.
- Re-scope Mat E 413 and 414 courses
  - These courses were re-scoped a couple of years ago and are undergoing continuous scrutiny. In acknowledgment of the faculty workload required to manage these two classes and the need for a fresh look at them, two faculty (rather than one as in the past) were assigned to each class the academic year of 2011-12.
- Materials processing courses lacking.

- A general materials processing course was recommended. Mat E 216 is increasing processing coverage and each specialization will address processing in its sequence. Currently under faculty consideration is a core processing course, with extensive lab coverage, to be taken in the junior year.

The spring 2012 Industrial Advisory Board

In a recent meeting the IAB reviewed a draft of this ABET self-study report and made suggestions for improvements. They also looked at some curricular proposals and gave their opinions. They wanted to see more flexibility in what students can choose for a career path in materials. A suggestion made to them was for dropping from two required materials specialties to one, while requiring those eliminated 9 credits are used as technical electives for materials courses. They concurred with this proposal. The faculty has since voted to enact this proposal starting in the fall of 2013. Another proposal for reorganizing the lab structure was considered and the IAB discussion concluded that we maintain lab content and be careful about making sure lecture content is aligned with lab content.

Finally a third measure of achieving the Program Educational Objectives is by tying these objectives to our Student Outcomes and demonstrating that these outcomes prepare our alumni to achieve the objectives. Consequently the following continuous improvement processes and results will be used to demonstrate the level of achievement of both the Program Educational Objectives and the Student Outcomes.

Many of the Student Outcomes are multidimensional, and it is sometimes possible to achieve part, without achieving all of a particular outcome. In the assigning of particular experience as appropriate to assessing achievement of an outcome, we have taken the broad interpretation of “contributing towards” achieving the outcome rather than “proves achievement of” an outcome.

It is important to recognize that students achieve these outcomes through participation in a variety of program elements (repeated here for convenience). These elements include the curriculum, supporting programs, and activities. Each will be discussed separately, and then formative and summative measures will be discussed. Program elements and their contribution to achieving program outcomes are shown in Tables 4-3 and 4-4.

TABLE 4-3 Materials Engineering Program Elements

Materials Engineering Program Elements		
Curriculum (C)	**Supporting Programs (P)**	**Supporting Activities (A)**
CB Basic Program and core engineering courses	**PE** Experiential Education (Co-op/Intern/ Summer)	**AS** Student Chapters of Professional Societies
CC Materials Core	**PI** International Program	**AH** Honoraries
CS Materials Specialization	**PH** Honors	**AO** Student Organizations
CT Technical Electives	**PR** Research	
CD Design	**PA** Advising	
CG General Education Elec.		

TABLE 4-4 Program Elements Contributions to Student Outcomes

	Student Outcomes	Contributed to by: (Primary)
a.	math, science, and engineering	CB, CC, CS, CT, PE, PI, PH, PR,
b.	design and conduct experiments	CB, CC, CS, CT, CD, PE, PI, PH, PR
c.	design a system, component, or process	CB, CC, CS, CT, CD, PE, PI, PH, PR,
d.	multi-disciplinary teams	CC, CS, CD, PE, PI, AS, AO
e	solve engineering problems	CB, CC, CS, PE, PR,
f.	professional and ethical responsibility	CC, CS, CD, PE, PA, AS, AO
g.	communicate effectively	CB, CC, CS, CT, CD, CG, PE, PI, PR, AO
h.	the broad education ….	CG, PE, PI, PH, AS, AO
i.	life-long learning	CC, CS, CT, CD, PE, AS
j.	contemporary issues	CS, CD, CG, PE, AS
k.	modern engineering tools	CC, CS, CT, CD, PE, PR
l.	apply advanced science to materials systems	CC, CS, CD, PE, PR
m.	integrated understanding (structure, properties, processing, & performance)	CC, CS, CD, PE, PR
n.	materials selection and design problems	CC, CS, CD, PE, PR
o.	experimental, statistical, and computational methods	CC, CS, CD, CT, PE, PR
p.	creative, independent problem solving skills, under time and resource constraints	CS, CD, CT, PE, PR
q.	to have gained experience	PE, PR
r.	to demonstrate hands-on	CS, CD, CT, PE, PR

Process to Assure Graduates have Achieved Outcomes

The process used to assure graduates have achieved program outcomes was designed after carefully examining Table 4-4. Clearly, almost all outcomes rely heavily on curricular content (as designated by a ‘C’). Therefore a significant fraction of assessment efforts are an evaluation of the efficacy of the curriculum.

Assessment Methods

Various assessment methods are used to ensure that program outcomes are met prior to graduation including:

Curricular

- Performance in individual courses
- Course evaluations
- Student Transcripts (grades)
- Professional practice (Design) experiences (final reports and presentations, evaluations from industry sponsors)

Supporting Programs & Activities

- Co-op/Internship Evaluations
- International Experience evaluations
- Honors programs of study
- Participation in Professional Societies and Student organizations
- Participation in Academic/National Laboratory Research

Summative Measures

- Student Feedback Session
- Senior Surveys and Exit Interviews
- Placement Data (for industry and graduate school)
- Alumni Surveys
- CAAP (Collegiate Assessment of Academic Proficiency) tests – pilot program on communication abilities

Not all methods are used (or are appropriate) for every desired outcome, but in most cases at least three are used to document achievement of each outcome. Selected assessment methods are discussed below.

Curricular Contribution to the Achievement of Program Outcomes

Table 4-5 shows how the desired outcomes are mapped against the courses required for a materials engineering degree to delineate which courses contribute to each of the outcomes. This mapping was done by five faculty committees: one for the out-of-department courses and the core curriculum and one for each of the four specialization areas. For each course within the department, the syllabus outlines the course objectives and outcomes as well as how they relate to the departmental objectives and outcomes. Course evaluations at the end of the semester are administered using the standard University form, but the department has a course evaluation addendum which addresses specifically the extent to which the student believes each of these outcomes has been met (both forms will be available at the time of the visit).

TABLE 4-5 Curricular Contribution to the Achievement of Student Outcomes

				Student Outcomes																
	<--------General Engineering------->												**Materials**					**Mat/ISU**		
Course (credits)	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**		**l**	**m**	**n**	**o**		**p**	**q**	**r**
Basic Program (27)																				
ENGR 160 (3)	√			√	√		√													
ENG 150 (3)							√													
ENG 250 (3)							√													
PHYSICS 221 (5)	√	√			√															
CHEM 177 (4)	√				√															
MATH 165 (4)	√				√															
MATH 166 (4)	√				√															
LIB 160 (1)							√		√											
ENGR 101 (R)						√	√													
Supporting (24)																				
PHYSICS 222 (5)	√	√			√															
CHEM 177L (1)	√	√	√		√															
CHEM 178 (3)	√				√															
CHEM 178L (1)	√	√	√		√															

MATH 265 (4)	√				√															
MATH 267 (4)	√				√															
EM 274 (3)	√				√						√		√							
EM 324 (3)	√				√		√		√				√							
Gen Ed Elec(15)						√	√	√	√	√										
Tech Electives (9)																				
Free Elective (3)						√	√	√	√	√										
Mat E Core (32)	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**I**	**j**	**k**		**l**	**m**	**n**	**o**		**p**	**q**	**r**
215 Intro Mat I(3)	√	√		√	√		√				√		√	√	√	√				√
215L Lab (1)	√	√		√	√		√				√		√	√	√	√				√
216 Intro Mat II(4)	√	√					√				√		√	√		√				√
214 Character. (3)	√	√					√				√		√	√		√				√
311 Thermo.(3)	√				√						√		√	√						
314 Kinetics (3)	√				√		√				√		√	√		√				
316 Comp.(3)	√	√		√	√		√				√					√				
317 Elec. Mat (3)	√				√		√				√		√	√	√					
418 Mech Prop(3)	√						√				√		√	√						
413 Prof Prac I(3)	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√		√		√
414 Prof Prac II(3)	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√		√		√
Mat E Specializations (choose two – 9 cr. each)																				
Ceramic Materials																				
321 Int. Cer. Sci.	√				√		√		√		√		√	√				√		
322 Cer. Proc.	√	√	√		√						√		√	√	√	√				√
425 Glass & Adv	√	√	√		√	√	√		√	√	√		√	√	√	√				√
Electronic Materials																				
334Int Elec Mat	√	√			√				√		√		√	√		√				
332Semicon Mat.	√		√		√				√	√			√	√	√					
433Adv Elec Mat.	√				√			√	√	√			√	√	√					
Metallic Materials																				
342 Struc Prop	√	√	√		√		√				√		√	√	√	√				√
443 Ferr Met	√	√	√		√		√		√	√			√	√	√			√		
444 Corr. & Failure	√	√					√				√		√	√		√				√
Polymeric Materials																				
351 Int Poly Mat.	√							√		√	√		√	√	√	√				
453 Phys Mech	√	√		√	√		√				√		√	√	√	√				√
454 Pol Comp Proc	√	√		√			√			√	√		√	√	√					
Co-op and/or Intern Experience																			√	

English Proficiency Requirement:

The Department of Materials Science and Engineering requires a grade of C or better in Engl 150 and 250 and one of the following; Engl 302, 309, 314 or JLMC 347. Recently, in order to attempt to better measure our students' ability to attain outcome g on communication, we entered a test of a writing assessment tool. In Spring 2010, the department volunteered to pilot an instrument new to ISU called CAAP (Collegiate Assessment of Academic Proficiency). The CAAP is the standardized, nationally normed assessment program from ACT that enables postsecondary institutions to assess, evaluate and enhance student learning outcomes and general education program outcomes. Because communication proficiency is an area of particular interest as expressed by the OPAL results and both the college and departmental industrial advisors, a CAAP essay writing test was selected. The test was administered both to 2nd semester freshmen (in 2010) and to 4th year seniors (in 2010). The testing was done according to official program guidelines and monitored by Kevin Saunders, who, at that time worked with the Assessment of Academic Programs office. Students were required to write two short essays in response to a particular prompt. These were intended to show whether the student could clearly engage the issue identified in the prompt and demonstrate skill in organizing, developing, and conveying in standard written English the writer's ideas about the topic. Eighteen freshmen and 29 seniors were tested. The national norm for the writing essay taken by any major any time during college is 3.2. Test scores for Materials engineering freshmen were 3.26 with a standard deviation of 0.55 and for seniors, 3.22 with a standard deviation of 0.61. These results do not show a statistically significant difference, either between the two populations or when compared to the national average. As we were the only department university-wide that administered the test to both freshmen and seniors, we are unable to fully evaluate this result. The person initiating this pilot study at the university level has left the university and his replacement has very recently been hired. When appropriate, we will consult with him to determine the best course of action for further tests and a more thorough evaluation of these results. Regardless, these results do not indicate either a strength or deficiency with respect to national averages. We continue to explore opportunities to assess our student's communication skills through nationally normed tests as supported by the university.

Supporting Programs and Activities Contribution to the Achievement of Program Outcomes

Co-op/Internship Evaluations: The accurate evaluation of students in the professional workplace can be an extremely valuable tool to assess the effectiveness of our program. Engineering Career Services oversees the process using OPAL ™ (**O**n-Line **P**erformance and **A**ssessment of **L**earning). Evaluations are administered to both the supervisor and the student. These evaluations reflect the competencies in which we are interested, and those competencies have been correlated to the ABET outcomes a – k. Since about 75 % of our Mat E students do a co-op or internship during their programs, these direct measures of performance are good indicators that our students are developing the abilities required by the expected outcomes. The data from this assessment tool are rich and are analyzed in a following section of this report.

Participation in Professional Societies and Student organizations: Most students participate in the field-specific professional societies, many in other student organizations and some in a leadership capacity. Although participation doesn't validate achievement of a particular outcome, it does suggest that the student has the opportunity to develop many "soft skills" which are more difficult to address in the classroom. More than half of the Mat E students are members of the professional society student chapter, The Material Advantage, and many take part and assume leadership roles in college and university organizations. The ISU Material Advantage student organization has been named Most Outstanding Chapter in the world for the past eight consecutive years, attesting to the students' participation and leadership in that organization.

Participation in Research: A significant fraction of students (~56%) work in a research lab (either academic or national lab) during their undergraduate career. This experience affords opportunities to apply analytical skills, gain an appreciation for lifelong learning, and hone their laboratory skills and facility with modern engineering equipment. In most cases these students are required to communicate their results and achievements in written/and or oral form.

Other opportunities that contribute to the meeting of these outcomes are described in Appendix II including university opportunities (intramural athletics, extracurricular activities, campus organizations, etc.), college opportunities (learning communities, college student organizations, etc.) and national conventions, student conferences, and honor societies

Qualitative and Quantitative Data & Documentation of Changes

Assessment of Workplace Competencies (OPAL)

In the Fall Semester of 2001, the College of Engineering implemented a constituent-created, competency-based, ABET-aligned assessment tool for the engineering experiential education workplace, using software called **O**nline **P**erformance and **A**ssessment of **L**earning (OPAL™). OPAL™ is a competency development and performance management software created by Development Dimension International (DDI, www.ddiworld.com), a global provider of competency-based performance assessment, development, coaching and learning tools. A complete description of the competency assessment process and its application in the continuous improvement process can be found at: http://www.engineering.iastate.edu/assess/. The survey itself is included below at the end of this section.

The premise in developing this tool was that an "ability" (stated in eight of the 11 Student Outcomes) is a complex combination of motivations, dispositions, attitudes, values, strategies, behaviors, self-perceptions, and knowledge of concepts and procedures, and that a complex ability cannot be directly observed and must be inferred from performance. Outcomes are each multi-dimensional and represent some collection of workplace competencies necessary for the practice of engineering at the professional level. Assessing Outcomes through competencies provides an additional independent measure

Workplace competencies are defined as the application of knowledge, skills, attitudes, values, and behaviors. They are directly measureable through actions or demonstrations of the existence of those competencies in the individual.

The College and DDI engaged a constituency of 200+ ISU employers, alumni, faculty, partnering international faculty, and co-op/internship students to assist the College in developing performance assessment tools, ones that would be aligned with the Outcomes. This process identified and validated 14 "ISU Competencies" that encompass the (a-k) ABET Student Outcomes. An additional competency, Safety Awareness, was added after faculty discussions.

Note that these are "ISU Competencies" that resulted from dialogue with our key stakeholders and may be different for programs at other institutions. The definition of each competency is clear, concise and independent of all others. Specific to each definition is a set of observable and measurable Key Actions that a student may take that demonstrates their development of that ISU Competency.

We have applied this tool to assess student achievement during co-ops and internships, to collect baseline data for our freshmen, as part of our graduating senior exit survey, and have administered it twice (every six years, most recently in the spring of 2011) as part of our alumni survey of graduates 3 – 5 years out. This tool measures "competencies" that we have aligned with the a-k outcomes. This alignment has been validated by Engineering Career Services through focus groups with over 200 employers, faculty, parents, and students. ECS has administered this instrument to 2749 engineering students (113 Mat E students) and 1891supervisors (87 of Mat E students) from 2006 to 2010.

Students and supervisors rate the student's competencies at the end of the internship period. The supervisor's direct measure is usually higher than the student's self-perception. The two measures, taken together, offer interesting glimpses into the abilities of our students. Through faculty, employer, student, and parent input the list of competencies was selected, aligned with the a-k outcomes, and validated. The outcomes a-k are multidimensional in nature and, therefore, difficult to measure directly. The competencies in OPAL™ are more easily measured directly. The validated alignment with the outcomes allows us to measure outcome achievement.

One drawback of OPAL™ is the anonymity of the data. All co-op and internship students in a particular semester are grouped together. Therefore, sophomores are grouped with juniors and seniors. Since the desired program outcomes are to be achieved by the time of graduation, some data points in this measure are two or more years away from the final achievement date. Since the data are only for students who go on co-ops or internships, is it a true measure of outcomes achievement for Mat E students? Since about 75% of all Mat E students (about the same as the overall college percentage) have a co-op or internship experience during their undergraduate degree program, a large portion of the student population is represented. The data are quite encouraging. TABLE 4-6 shows the alignment of the OPAL™ competencies to the a-k outcomes. It also shows the weighting factors used to determine numerical scores on outcomes since one competency may contribute more toward an outcome than another.

TABLE 4-6. Outcomes (a-k) vs. Competencies Matrix with Weighting Factors

ABET OUTCOMES VERSUS ISU COMPETENCY MATRIX

Engineering Criteria 2000 Criterion 3 Program Outcomes and Assessment		ISU Competency													
		Engineering Knowledge	General Knowledge	Continuous Learning	Quality Orientation	Initiative	Innovation	Cultural Adaptability	Analysis and Judgment	Planning	Communication	Teamwork	Integrity	Professional Impact	Customer Focus
(a)	an ability to apply knowledge of mathematics, science, and engineering	4.8 ✘		3.8 ✘		3.5 ✘			4.3 ✘						
(b)	an ability to design and conduct experiments, as well as to analyze and interpret data	4.4 ✘		3.6 ✘	4.3 ✘	3.7 ✘	4.0 ✘		4.5 ✘	4.1 ✘		3.4 ✘			3.4 ✘
(c)	an ability to design a system, component, or process to meet desired needs	4.4 ✘		3.8 ✘	4.1 ✘	3.9 ✘	4.3 ✘	3.0 ✘	4.5 ✘	4.2 ✘	4.0 ✘	3.8 ✘			4.2 ✘
(d)	an ability to function on multidisciplinary teams					4.0 ✘		4.3 ✘	3.6 ✘	3.8 ✘	4.7 ✘	4.9 ✘	4.3 ✘	3.9 ✘	3.7 ✘
(e)	an ability to identify, formulate, and solve engineering problems	4.7 ✘		3.8 ✘	3.9 ✘	4.1 ✘	4.2 ✘		4.4 ✘		3.7 ✘	3.6 ✘			3.6 ✘
(f)	an understanding of professional and ethical responsibility		3.8 ✘	3.6 ✘	3.3 ✘			3.7 ✘	3.5 ✘				4.7 ✘		
(g)	an ability to communicate effectively		3.8 ✘			3.7 ✘					4.9 ✘			4.2 ✘	4.0 ✘
(h)	the broad education necessary to understand the impact of engineering solutions in a global and societal context	3.4 ✘	3.9 ✘	3.9 ✘				4.1 ✘	3.5 ✘						
(i)	a recognition of the need for, and ability to engage in, life-long learning			4.6 ✘		4.1 ✘									
(j)	a knowledge of contemporary issues		3.7 ✘	3.8 ✘				3.8 ✘	3.1 ✘						
(k)	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	4.3 ✘		4.2 ✘	3.6 ✘	3.7 ✘		2.6 ✘	4.0 ✘						

The actual results for Mat E students in the period 2006-10 are shown in FIGURES 4-1 and 4-2 and TABLE 4-7. FIGURE 4-1 shows the achievement of competencies. A rating of 3 corresponds to the student “sometimes” demonstrates the competency. Each competency has between 3 and 6 “key actions” that are specific and measurable. A rating spans the range between behavior is witnessed “never or almost never” (a rating of 1) up to “always or almost always.” (a rating of 5). It is interesting to note that in every instance the supervisors rate the student higher than the student rates him/herself. This seems to add validity to survey measures of student perceptions of their achievement of program outcomes.

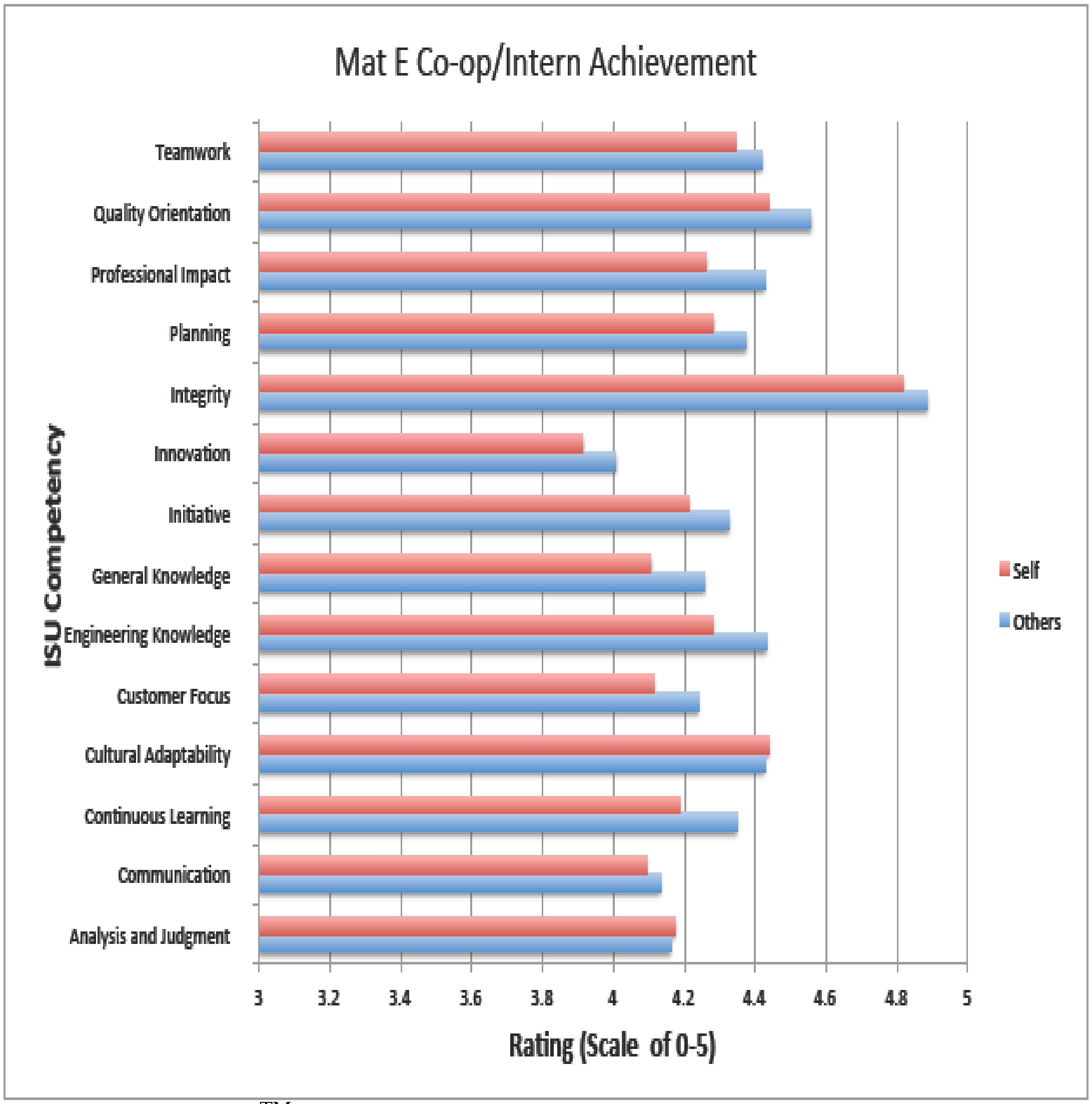


FIGURE 4-1 OPAL™ Competencies are Being Achieved by Mat E Students

TABLE 4-7 also shows almost perfect agreement among students and supervisors about which of the competencies they are "best" at and which are the worst. Here the term worst is comparative since the students rate highly in all competencies. FIGURE 4-2 shows the most important pieces of information in regards to this report, that the Mat E students are achieving the program outcomes a-k. The lowest rating shows an 84% achievement rate for students who are one, two or even three years from graduation.

TABLE 4-7 **Mat E Top 5/Bottom 5 Competencies**
(Experiential Education Workplace 2006-10)

Mat E	
Supervisor	**Student**
TOP 5	
Integrity	**Integrity**
Quality Orientation	**Quality Orientation**
Professional Impact	Cultural Adaptability
Engineering Knowledge	**Teamwork**
Teamwork	**Professional Impact**
BOTTOM 5	
Customer Focus	Initiative
Analysis and Judgment	**General Knowledge**
General Knowledge	**Customer Focus**
Communications	**Communications**
Innovation	**Innovation**

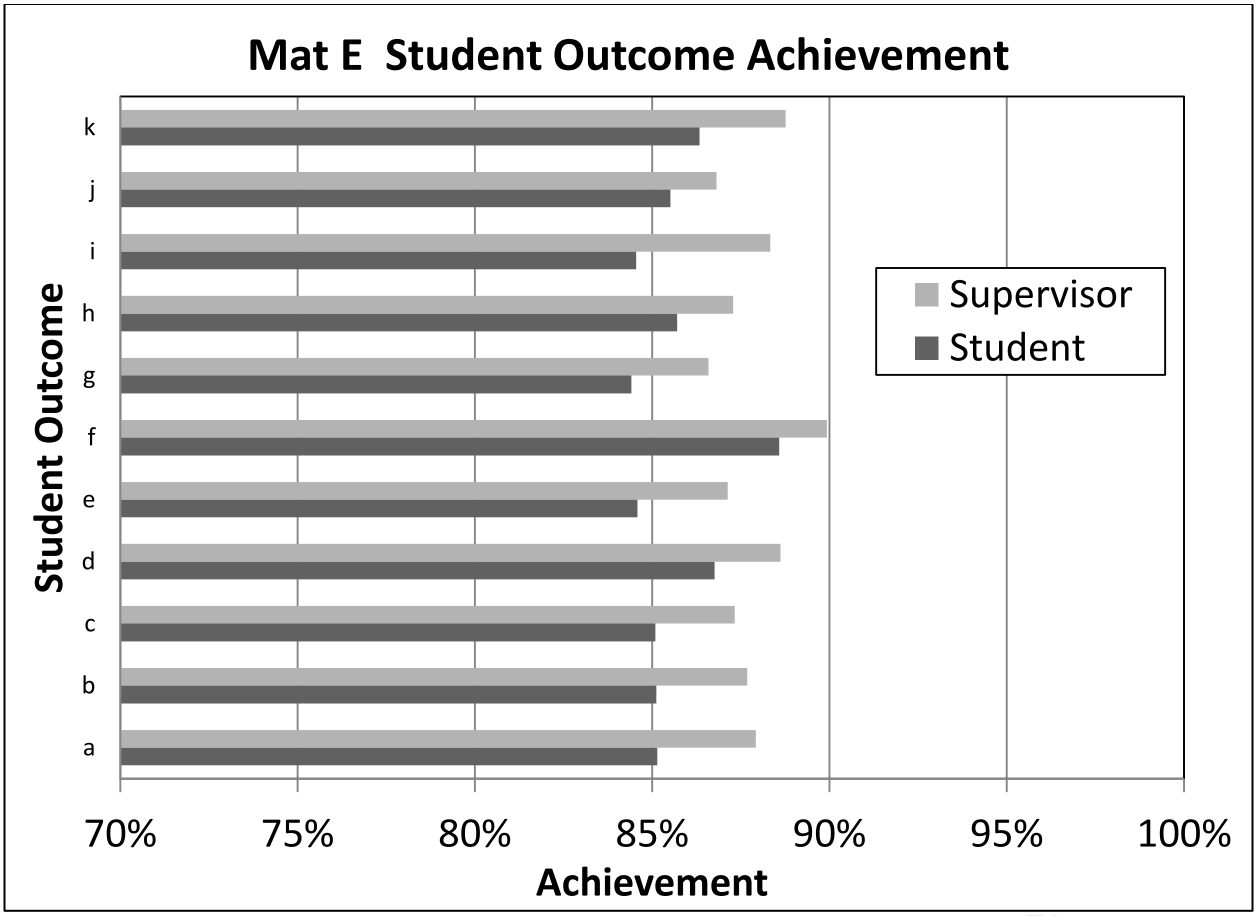


FIGURE 4-2 Program Outcomes a-k are Being Achieved as Measured by OPAL™
(spring 2006-spring 2010 co-op/intern students in Mat E)

Course Evaluations

We use a standard course evaluation form with a supplement added for student self-evaluation of student outcome progress at the end of each Mat E course. The survey is divided into two areas "the course" and "the instructor." Departmental averages for "the instructor" are traditionally the highest in the college – at 4.1/5.0 in the most recent academic year. When asked if the stated goals of the course were attained, 87% of the students said "yes." This information allows us to conclude that the students perceive that both the quality of the instruction and course content is high. Both the university forms and the departmental supplement will be available at the time of the visit. Next year the entire university is switching to online course evaluations. At that time, our program plans to implement formative as well as summative course evaluations.

Outcomes Ratings (Supplemental Course Evaluation Forms)

TABLE 4-8 shows the program outcomes correlated to individual Mat E courses within our program. A check mark indicates that the individual course contributes towards the development of a student in the process towards achieving the stated outcome. Red check marks represent outcomes that were rated by students as below 3 two offerings in a row in the past 6 offerings (on a scale of 1, “course does not contribute to this outcome,” to 5, “course contributes significantly to this outcome”).

TABLE 4-8 Student Outcomes Progress Ratings by Course

				Student Outcomes																
	<--------General Engineering------->											**Materials**					**MSE/ISU**			
Course (credits)	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**		**l**	**m**	**n**	**o**		**p**	**q**	**r**
Mat E Core (32)	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**I**	**j**	**k**		**l**	**m**	**n**	**o**		**p**	**q**	**r**
215 Intro Mat I(3)	√	√		√	√		√				√		√	√	√	√				√
215L Lab (1)	√	√		√	√		√				√		√	√	√	√				√
216 Intro Mat II(4)	√	√					√				√		√	√		√				√
214 Character. (3)	√	√					√				√		√	√		√				√
311 Thermo.(3)	√				√						√		√	√						
314 Kinetics (3)	√				√		√				√		√	√		√				
316 Comp.(3)	√	√		√	√		√				√					√				
317 Elec. Mat (3)	√				√		√				√		√	√	√					
418 Mech Prop(3)	√						√				√		√	√						
413 Prof Prac I(3)	√	√	√	√	√	√	√	√	√	√	√		√ (red)	√	√	√ (red)		√		√
414 Prof Prac II(3)	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√		√		√
MSE Specializations (choose two – 9 cr. each)																				
Ceramic Materials																				
321 Int. Cer. Sci.	√				√		√		√		√		√	√				√		
322 Cer. Proc.	√	√	√		√						√		√	√	√	√				√
425 Glass & Adv	√	√	√		√	√	√		√	√	√		√	√	√	√				√
Electronic Materials																				
334Int Elec Mat	√	√			√				√		√		√	√		√				
332Semicon Mat.	√		√		√				√	√			√	√	√					
433Adv Elec Mat.	√		√ (red)		√			√	√	√			√	√	√					
Metallic Materials																				
342 Struc Prop	√	√	√		√		√				√		√	√	√	√				√
443 Ferr Met	√	√	√		√		√		√	√			√	√	√			√		
444 Corr. & Failure	√	√					√				√		√	√		√				√
Polymeric Materials																				
351 Int Poly Mat.	√							√		√	√		√	√	√	√				
453 Phys Mech	√	√		√	√		√				√		√	√	√	√				√
454 Pol Comp Proc	√				√		√			√	√		√	√	√					
Co-op and/or Intern Experience																			√	

Each specialization committee examines the data for courses in that area and develops an action plan to correct the deficiency or restate contribution to outcomes. The courses in the materials core are similarly evaluated by the department's curriculum committee. These committees examine the low-rated outcomes each semester for possible action. The committees looked at the original outcomes specified and the results being gathered each semester when the degree program and these outcomes assessments by course were first put into place (fall, 1999) to determine if the appropriate outcomes were being specified. In many cases outcomes were inappropriate for the course and were removed from the assessment process for that course. The tables shown in this document represent the current outcomes being assessed and analyzed.

Since student outcome C received a low rating for two offerings in a row for Mat E 433 (one of the courses in the electronics specialty), the curriculum committee did a review and discussed this with the specialty committee and the teaching faculty involved. That faculty member said that "There are a couple of places in the course that I address issues regarding to design. An example is the base-metal multilayer ceramic capacitors. Pd was used as electrode previously. However, its price has gone up a lot since 2000. So Ni was then introduced as the electrode material to control the cost. To avoid oxidizing Ni electrode and reducing BaTiO3 dielectric during high temperature firing, defect chemistry knowledge is used to design new compositions with acceptor dopants." However he felt, and the curriculum and specialty committees concurred, that this was not sufficient coverage of design to consider this course as one that had a significant impact on student outcome C to measure that outcome in this class. It will be removed from measurement for this class in the future.

Mat E 413, the first of two senior design courses, has undergone numerous changes over the past six years (and longer). Mat E 414, the second of the two senior design courses, is heavily reliant on industrial projects. The outcomes for 413 were low for two years in a row (student outcomes L and O were below three in the falls of 2007 and 2008) after this course removed the industrial projects. Those industrial projects are planned for in 413, but executed in 414. As an outcome of discussions at that time with our IAB and others we decided that more coverage of topics such as project management, team behavior and tools, materials selection software, etc. was needed in 413 rather than working on the industrial projects for two semesters. After some initial roughness in changing the way 413 operated, and consequently the two offerings of low ratings for L and O, these ratings were above three the next semester offered (fall 2010), but L dropped below 3 again in fall 2011. Our recent study of 413 and 414 will result in more changes to these courses and the outcomes will be monitored closely again.

Summative assessment

Graduating Seniors

Senior surveys have been conducted since the fall semester of 2009 using a new survey instrument and the program Survey Monkey. The same OPAL questionnaire is used for graduating seniors, since the fall of 2007, as is used for interns and co-op students (and alumni and entering freshmen) to better reflect stated objectives and outcomes. A total of 44 senior exit surveys have been responded to from fall 2009 through fall of 2010, and a total of 76 OPAL questionnaires from fall 2007 through summer 2011. The senior surveys allow us to track information about what percentage of our students

a. Go to graduate school (29%) rather than taking a job

b. Work in a research lab as an undergraduate (56%)
c. Study abroad (31%)
d. Participate in an internship or co-op (69%)
e. Choose which specializations (Ceramics – 55%, Electronics – 25%, Metals – 94%, Polymers – 44%: NOTES: students must complete two specialties and some complete three)
f. Are members of our student organization, Material Advantage (85%)

Student Feedback Sessions

A program feedback session is held at least once per year, and additional sessions are held when a particular issue arises. Often those issues don't have anything to do with the program or achieving student outcomes, so only those student feedback sessions which do relate to this self-study will be included here. In addition, our professional society student group, The Material Advantage, is quite large (over 100 members) and very active (they have been named outstanding student chapter in the world the past eight years). This group holds discussions and presents their suggestions to the group's faculty advisor or to the department's associate chair who is responsible for the undergraduate program. The students have formulated their own online feedback system to allow any student in the department to provide input. Finally, several students developed a study of senior design as a writing assignment in a technical writing course. Feedback from these sources in the past few years has presented us with several issues. Some of the repeated comments from these sessions, and the department's corrective action, are;

- Sequencing issues addressed – more flexibility for the program –
    - Studied pre-requisites to make sure that unnecessary ones were dropped. Created a three credit service "Intro to Materials" course that can be taken in lieu of the lecture component of Mat E 215 during spring and summer semesters. In addition, the summer Brunel course also substitutes for Mat E 215. This allows students who transfer into Mat E (about half of our total graduates) to get started in an out-of-sequence semester.
- Getting harder to find a research position in the department –
    - Advisors and Associate Chair for Undergraduate Programs serve as conduits to direct students to research jobs and vice-versa.
- MatLab course before they take Thermo
    - This is being developed at this time and will be offered in the fall of 2012
    - Offered Matlab voluntary course pre-fall 2010
- Seminar course in each grade dealing with topics like ethics, business practices, negotiating a job offer, understanding a benefits package
    - A sophomore level course, Mat E 201 was developed to address these concerns. It is now required within the core.
- Not a change – but continue to offer the graduate school information session each fall semester
    - This continues
- Open lab space for quiet studying

- One of our teaching labs was designated as this space. It has been outfitted with a computer and projector for students working on team projects. We are now planning a renovation of this lab space into a student meeting and innovation center, with the lab equipment being moved to another lab room.
- Students developed a study and report on our senior Professional Practice/Design sequence as part of a technical writing course assignment. This report surveyed students who were in or had finished this sequence. The students had several recommendations concerning starting the second semester projects earlier (during the first semester), having more industry-based projects, and covering more design tools in the first semester – specifically materials selection software.
    - This report became part of our analysis of this senior sequence when we assigned two instructors to the courses for the 2011-12 academic year instead of the usual one instructor. The results of this study were that a consistent written agreement with industries was developed to cover project work, a more focused syllabus for the first semester was developed, and earlier project assignments are to be made.

Placement Data

The placement data are managed through a variety of sources. The college maintains a database, and we also rely on faculty, advisors, and staff who make personal contact with the students before and after graduation. TABLE 4-9 shows placement within six months of graduation.

TABLE 4-9 Placement Data for 2006-11

Academic Year	# of Grads	# of Grads Reporting	Took Jobs	Grad School	% Placed*	Not Placed
06-07	39	34	25	9	100%	0
07-08	37	28	17	10	96%	1
08-09	33	26	12	13	96%	1
09-10	47	32	12	12	78%	8
10-11	27	26	9	10	73%	7
TOTAL	183	146	75	54	88%	17

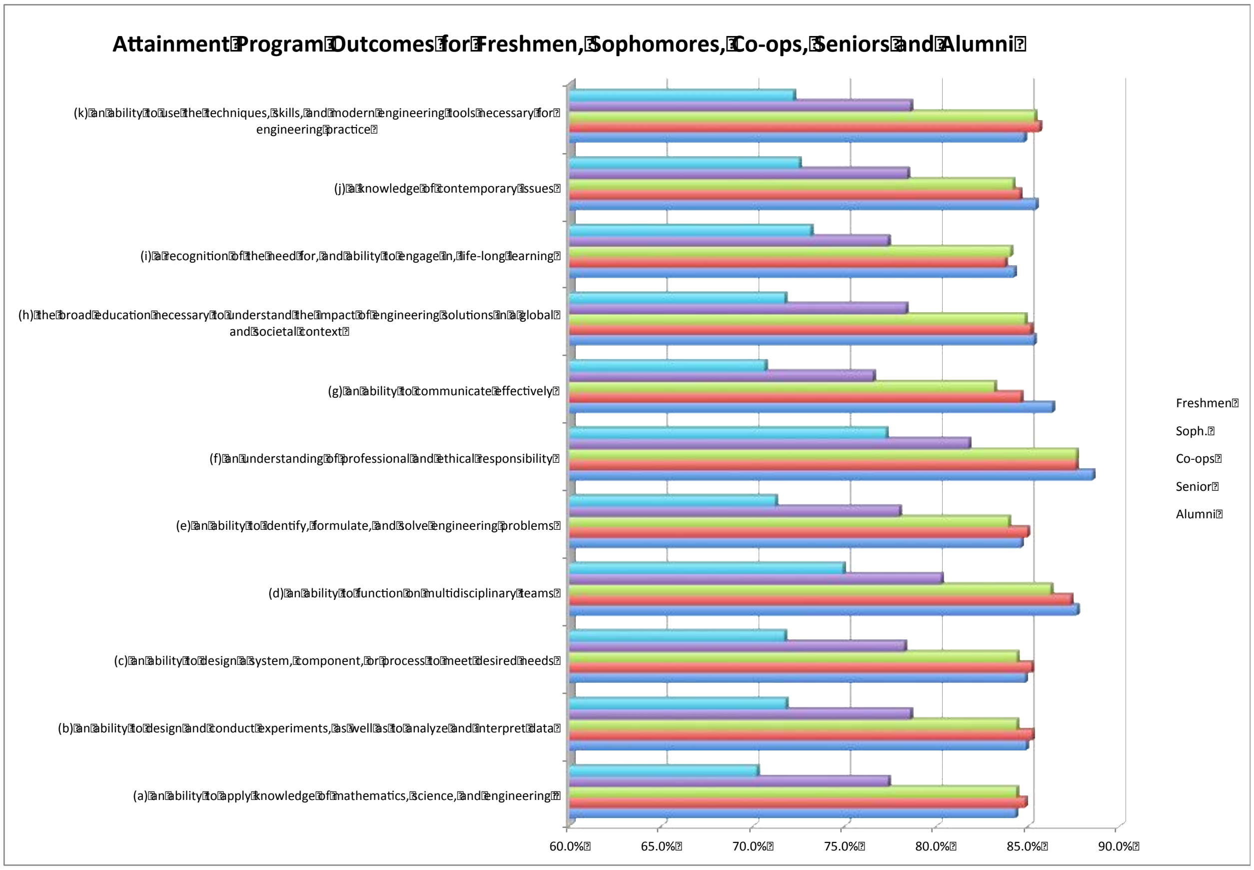
<u>Graduate Surveys</u>

Graduate surveys are administered by Engineering Career Services (ECS) starting in 2011. A standard survey was developed in 2010 by the College of Engineering ABET Committee. The first portion of the survey contained questions asked of graduates of all programs in the College. The second portion of the survey was developed by the individual programs for their graduates, and the OPAL survey instrument was used by materials engineering for this part. ECS maintains and verifies a database of email contacts for all graduates.

The survey was delivered electronically in 2011 using the ISU Career Management System (CMS). CMS tracks responses, sends reminders and, at the end of the survey period, generates reports for use by the program. The response rate for our materials engineering alumni was 26.4% (23 of 87). Graduates from three to five previous years were surveyed. The survey itself is included below at the end of this section. The results show the graduates who responded are in diverse jobs and graduate school. They found internships, international experiences, and undergraduate research to be important to their success after graduation. About half of them have completed a master's degree and 20 % have started work on a Ph. D, They feel they work well in teams, have good communication skills, and are engaged in lifelong learning.

Since all of the outcomes are being achieved according to this measure, so are all the objectives according to the alignment of objectives and outcomes as shown in TABLE 3-1.

FIGURE 4-3 Freshman, Sophomore, Co-op, Graduating Senior, and Alumni Achievement



ANALYSIS of OPAL Data on Student Growth for 2006-2011

Part of our evaluation of student learning relies on the OPAL tool administered through engineering career services. Data has been collected for freshmen, sophomores, co-op/internship students (and their supervisors), graduating seniors, and alumni. OPAL measures 15 competencies that are aligned with, but not the same as ABET criteria.

Table 4-10 below shows an analysis of the competency rankings by students in five "growth" periods; as freshmen, sophomores, during co-ops, as graduating seniors, and finally as alumni 3 to years after graduating. Freshmen do the OPAL survey during their ENGR 101 class (for those freshman already declared as Mat E majors). Sophomore Mat E majors do the survey in Mat E 201.

Table 4-10 Growth of Student Rankings in OPAL

101- Engr. 101, 201- MatE 201, C – co-op or internship, S – graduating senior, A – Alum.

COMPETENCY	**Rank (for 101,201,C,S,A)**	**top 5**	**middle 5**	**bottom 5**
Analysis and Judgment	5, 5, 11, 6, 7	101, 201	C, S, A	
Communication	12, 15, 14, 11, 14			**ALL**
Continuous Learning	6, 11, 10, 14, 10		101, C, A	201, S
Cultural Adaptability	4, 4, 2, 5, 8	101,201,C,S	A	
Customer Focus	14, 10, 12, 12, 12		201	101, C, S, A
Engineering Knowledge	15, 13, 6, 7, 15		C, S	101, 201. A
General Knowledge	11, 9, 13, 13, 4	A	201	101, C, S
Initiative	10, 12, 8, 10, 6		101, C,S, A	
Innovation	13, 14, 15, 15, 11			**ALL**
Integrity	1, 1, 1, 1, 1,	**ALL**		
Planning	9, 8, 5, 9, 9	C	101,201,S,A	
Professional Impact	7, 7, 7, 3, 2		101,201,C	S, A
Quality Orientation	3, 3, 3, 4, 5,	**ALL**		
Safety Awareness	8, 6, 9, 8, 13		101,201,C	S
Teamwork	2, 2, 4, 2, 3	**ALL**		

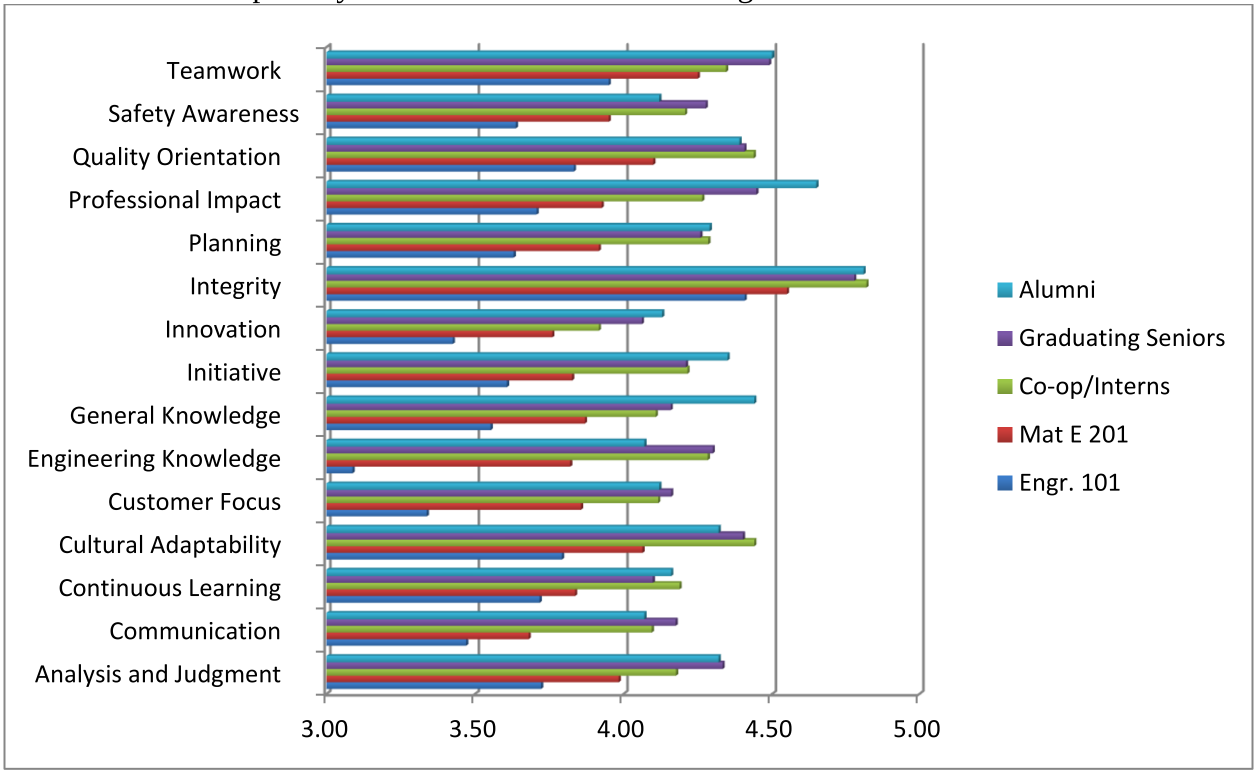
To read this table – Competencies are listed on the left – the 'rank' is the score students give themselves based on the survey (which includes 79 key actions); 1 is the highest, 15 is the lowest. The top 5, middle 5 and bottom 5 are listed for each group of students that took OPAL surveys in the last 5 years.

General Observations

Throughout their academic and early professional careers our students believe that they have integrity and strong quality orientation and have strong teamwork skills. Throughout their academic and early professional careers, our students believe that they are weak in communication and innovation. Also, throughout their academic and early professional careers, our students do not feel they are particularly strong in continuous learning, customer focus, initiative, professional impact and safety awareness. Alumni are particular concerned about safety awareness. Student perception of their engineering knowledge steadily improves throughout their academic career, until they become alumni. The weakest key action for this competency (by far) is 'knowledge of mathematics' with a rating of 3.83/5. This, and "maintains audience attention" in communication (3.63) are the lowest key action for alumni in all categories.

Figure 4-4 shows the growth of OPAL competencies over these same measurements.

Figure 4-4 OPAL Competency Growth from Freshmen through Alumni



Process Flowchart

The flow sheet for the evaluation and continuous improvement process of this program element is shown in Figure 4-5. This process occurs on a yearly basis. For curricular evaluations, the results of the students' perceptions are compared to those of the faculty, and discrepancies are carefully examined. Continuous improvement is also facilitated by the maintenance of a course portfolio in which the faculty write a self-reflective memo on the course and outline future plans in light of the feedback. This process occurs on a per course offering basis (usually yearly).

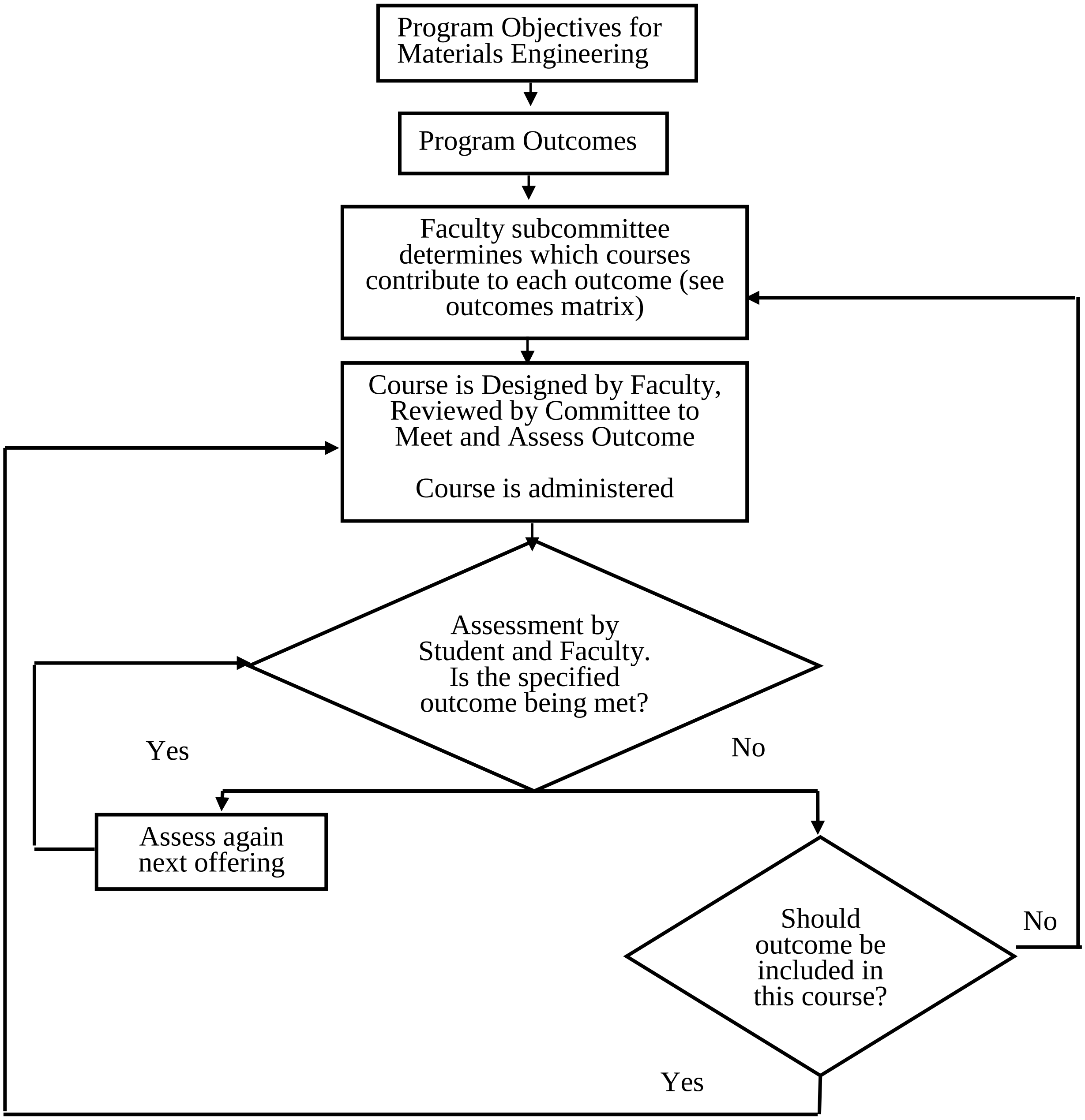


FIGURE 4-5 Process for evaluating student and faculty self-assessment of meeting outcomes for each Materials Engineering Course.

Faculty retreats focusing on curriculum are held periodically (approximately every two years). This gives the opportunity for the faculty to consider the curriculum as a whole.

Curricular changes to complete the assessment/revision loop
Curricular changes are made periodically, informed by assessment results and environmental scans. These changes are described for the materials core and the four specializations. Additionally, there have been changes in requirements in courses outside of Mat E courses.

Core materials program update and revision, 2006 - 2012

The materials core today consists of Mat E 201, 214, 215, 215L, 216, 311, 314, 316, 317, 413, 414, and 418. The courses from the core that have undergone changes since 2006 will be discussed in this section.

Mat E 201 (Materials Science and Engineering - Professional Planning): This R-credit (required, but carries 0 credits toward graduation) course was instituted in the fall of 2007 primarily at the request of our students who felt they needed more program-specific preparation for the professional planning of their materials careers. They learn about such things as interviewing techniques, international opportunities, ethics, graduate school preparation, and alternative career paths.

Mat E 215, 215L, (Introduction to Materials Science & Engineering I and lab separately listed for ease of transfer courses), ***216*** (Introduction to Materials Science & Engineering II), and ***317*** (Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials): Mat E 215, 215L, and 216, our eight-credit introductory courses, are considered by our students and our faculty to be our most important undergraduate courses. Consequently, we have assigned our best instructors to teach these courses. The assessment data show that those program outcomes that we have determined to be related to these courses (see TABLE 4-8) have been achieved each semester ("achieved" is measured here as an average score of 3/5 or better). This introductory set of courses were implemented in the fall of 2009 after consultation with all stakeholders, especially faculty, students, and our Industrial Advisory Board, indicated a need for greater fundamental strength in all materials rather than more focused knowledge in one type of material. These constituents also noted the need for an understanding of the electronic properties of materials for all Mat E graduates (and not just those who chose our electronic materials specialty). Consequently, we increased our introductory courses from one, five-credit course (the former Mat E 211) to two (technically three including the separately listed 215L), four-credit courses. We also instituted a new three-credit electronic materials course in the core, required for all Mat E graduates, 317.

Mat E 311 (Thermodynamics in Materials Engineering) and ***314*** (Kinetics and Phase Equilibria in Materials): These two courses were re-numbered and had the semester of offering changed in the 2007-08 academic year. Previously Thermo (then numbered 212) had been offered in the spring of the sophomore year and Kinetics (then 315) had been in the fall of the junior year. The two faculty teaching these courses wanted to have them offered back-to-back in the junior year to allow the very coupled transition from Thermo to Kinetics to go more smoothly. The students agreed that too much was lost over the summer, making Kinetics more difficult than necessary. Also, gains in academic maturity help with the difficult subject matter in thermodynamics.

Mat E 413, 414 (Materials Design and Professional Practice I and II): These two three-credit courses are our design and professional practice sequence. In the fall of 2007 we dropped a two-credit, junior level design course (Mat E 313) and increased both 413 and 414 from two to three-credits. The students felt, and the faculty concurred, that the teams being used to work on design projects didn't function well. The disparity between juniors and seniors in course-content knowledge and experience made it difficult to distribute team tasks in an equitable manner. The seniors felt “they did it all” with little help and the juniors felt they were “being left out” of the process decision making steps. With the increasing enrollment and the logistics of the number of industry-based projects needed, we felt the best improvement was to eliminate the junior-level portion of the design experience.

Mat E 418 (Mechanical Behavior of Materials): Starting in the fall of 2011 this three-credit course will no longer have a lab included. The faculty felt there was so much content that needed to be covered that three credits of lecture were needed. On the other hand, the students felt the labs used would have been good fundamental knowledge (hence, in the sophomore year labs) to help them understand material from courses they had already taken by time they got to 418. The labs formerly taught in 418 have been moved and adjusted for use in 216. Starting in the spring 2012 offering, Mat E 418 will no longer measure student outcomes B, O, and R as these are seen as having been integral to the removed lab component. Previously, in the fall of 2007, this course was re-numbered to 418 from 318. This was a reflection of the way students enrolled in the class. They wanted to complete EM324 before taking Mat E 318, so they merely waited until their senior years to take 318. To honor that existing student process, we changed the number to a senior year 418.

Specialties
In fall 2009, as part of the increased coverage of the fundamentals of all materials, all four specialties were decreased from four to three courses and the possibility of a proposal-based specialty was created. The specialty committees each deliberated on how best to do reduce from four to three courses and those changes are detailed below after the proposal-based specialty discussion, along with any other changes in that specialty.

Our curriculum committee devised a proposal-based materials specialty that students could (if approved by the curriculum committee) use as a substitute for one of the two specialties they would have otherwise chosen. This was done to add flexibility to the curriculum for students whose career goals weren’t best served by the existing options. This proposal-based specialty began in the fall of 2009 and we have had only a handful of students propose, and have approved, such a specialty. All but one of them did a biomaterials-related specialty. The one exception was a student whose career goal was to go into sales in materials engineering. That student proposed a sales/materials related specialty to integrate with both her materials engineering degree program and her sales engineering minor. The rules for students who would like to propose a specialty to meet their career goals are as follows.

Proposal Based Specialization

A student may choose to replace one of the 3-course specializations with a proposal-based specialization (PBS) of their own design. The student must apply for acceptance into the PBS program by creating a program of study justifying the choice of each course as well as a statement concerning the overall purpose of the proposed specialization. This proposal is submitted to the curriculum committee with a completed approval form early in the semester after the academic requirements for acceptance are met; usually during the second semester of the student’s sophomore year. The proposal will be evaluated by the curriculum committee, with the aid of faculty familiar with the proposed specialization.

Limitations:

1. The proposed course substitutions should be technical or semi-technical in nature; coming from any engineering, physical or life science department. There are cases where the committee will consider non or semi-technical based proposals (see below for requirements).

a. Example: “Materials and Art Restoration” or “Environmentally Friendly Materials”

2. This program is meant to add flexibility to materials science, not act as an alternative to a minor. If a minor is available from ISU for the proposed study, the application will be rejected.

Requirements for Acceptance:

1. A minimum cumulative GPA of 3.0 is required (3.3 is *recommended*) at the time of application to the program.
    a. This must be based on at least 45 credits, 30 which must be ISU credits
    b. Must include: Engr 160, Math 165, 166, 267, MatE 215, MatE 215L, Phys 221, Chem 177, 177L. 178, 178L (or equivalents)
    c. A grade of B+ or better must have been earned in MatE 215
2. A completed approval form which includes permissions from the student’s Mat 215 and 215L instructors, academic advisor, and at least one other faculty member.
3. The proposal must include a complete proposed “program of study” (POS) for all remaining semesters. Any future changes to this POS must be proposed to the curriculum committee.

Proposal Requirements:

1. Clearly state the overall intent of the proposed specialization. Reference materials are recommended.
2. Proposal must specify a minimum of 3 courses and 9 credits. Justify the selection of each course.
    a. At least two courses must come from any engineering department, physics, chemistry, math or the life sciences and must be 300 level or greater.
    b. Courses *may* be selected from other departments if the arguments for selection are compelling, in the opinion of the committee
    c. The use of 490’s is discouraged. If a 490 is proposed a justification for the course and details about the course must be specified.
3. The proposal must meet a standard of “academic merit” and “reasonable intention” in the judgment of the committee.
4. The committee may choose to interview the candidate to assess the merit of the proposal.

Other Restrictions:

1. Any subsequent changes in the proposed specialization must be pre-approved by the curriculum committee.
2. PBS may not be used to “avoid” a class in one of the four specializations

The approval form used when submitting the proposal is as follows.

APPROVAL FORM FOR PROPOSAL BASED SPECIALIZATION

Name: ______________________________________

ID #: ____

Checklist of Requirements:

- ☐ Minimum cumulative GPA of 3.0 (3.3 recommended) at the time of application (based on min. of 45 credits – at least 30 from ISU)
  GPA = _____ on ____________ (date of application)
- ☐ Has taken Engr 160, Math 165, Math 166, Math 265, Mat E 215, Mat E 215L, Phys 221, Chem 177/177L and Chem 178/178L (or equivalents)
- ☐ Must have earned a minimum grade of B+ in Mat E 215 & Mat E 215L
- ☐ Letter of permission from Mat E 215 instructor
- ☐ Letter of permission from Mat E 215L instructor
- ☐ Letter of permission from academic advisor
- ☐ Letter of permission from additional MSE faculty member:
- ☐ Provide a POS for all remaining semesters in degree program

Name of Specialization: ____

Courses selected to meet specialization:

Number	Title	Credits
________	____	_______
________	____	_______
________	____	_______

ACTION: ☐ APPROVED ☐ DENIED DATE: _________________________

NOTES:

____

____

____

____

____

Ceramics specialization program update and revision, 2006-2012

Summary:
The ceramics committee decided to combine the last two courses of the previous sequence into one. That course, Mat E 425 (Glasses and Advanced Ceramics) is now the third and last course in the sequence shown in Table 4-11. With the additional fundamentals in 216, and the inclusion of dielectrics in 317, 321 is better able to prepare students for the combined course, 424.

TABLE 4-11 Ceramics Sequence Changes

Previous Sequence (since 2004)	**Revised (2009)**
Mat E 321, Introduction to Ceramic Science	Mat E 321, Introduction to Ceramic Science
Mat E 322, Introduction to Ceramic Processing	Mat E 322, Introduction to Ceramic Processing
Mat E 423, Glass Science and Engineering	Mat E 424, Glasses and Advanced Ceramics
Mat E 424, Advanced Ceramic Engineering	

Electronics specialization program update and revision, 2006-2012

This sequence of courses (Mat E 334, 332, 433), also begun in the fall of 2009 was created by the electronic materials committee by eliminating one course (Mat E 432, Microelectronics Fabrication Techniques) as a requirement and revising the introductory course (Mat E 334, Electronic Properties of Materials). The eliminated course is still taught and available as a technical elective for any students who choose to increase their knowledge in this area. Since Mat E 317 introduces all Mat E students to the electronic properties of materials, the previous first course in the electronic materials specialty had to be revised to use that new course (Mat E 317) as a pre-requisite and take the fundamental coverage of electronic materials further than it had been in the previous sequence. As was mentioned previously student outcome C has been removed from those measured in Mat E 433. Due to the introduction of Mat E 317, topics were adjusted in the introductory course for the electronics specialty, Mat E 334. That required a shift in the outcomes being measured in this course. The outcomes now applied to this course, as shown in tables C4.3 and C4.6 are A, B, E, I, K, L, M, and O. Outcomes C, J, and N, formerly included in the introductory course, were removed and replaced by B, K, and O.

Metals specialization program update and revision, 2006-2012

The metals specialization committee reduced from four to three courses by eliminating Mat E 341, Metals Processing and Fabrication. The faculty felt that the increased coverage of the fundamentals in the sophomore year courses would eliminate the need for this course. The other three courses remained unchanged and they are 342, 443, and 444.

Polymer program update and revision, 2006-2012

The polymer specialty committee decided, like the electronic specialty committee, to eliminate the requirement of one course, knowing that course would still be taught and could be taken as a technical elective. That course is Mat E/Ch E 442 (now Ch E 447), Polymers and Polymer

Engineering and is taught by the Chemical and Biological Engineering Department. Because this course includes both ChE majors, who have had a course in organic chemistry, and Mat E majors, many of whom had not, the students were either bored or lost depending on the amount of review/coverage of organic chemistry done by the course instructor. Mat E students who now choose to take this course are also advised to take organic chemistry first. The required polymer sequence is now 351, 453, and 454, the three remaining courses from the previous sequence. The last two courses in this sequence have been revised a bit in the past year or two with some topics changing from one course to the other in order to better sequence the material. This was done after careful analysis by the polymer specialty committee and the faculty teaching the courses. This has necessitated a few changes in the outcomes to be assessed starting next year in each of these two courses. The new outcomes to be measured are shown in Table 4-12. The changes were to drop outcome J from 453 and outcomes B, D, O, and R from 454. The changes were mostly due to the major structural change of having the lab along with 453 and not in 454. Outcomes B, D, O, and R were felt to be best measured in the lab course, while J was now covered in 454 instead of 453.

Table 4-12 Student Outcomes for Polymers Courses 453 and 454

	A	B	C	D	E	F	G	H	I	J	K		L	M	N	O		P	Q	R
Polymeric Materials																				
453 Phys Mech	√	√		√	√		√				√		√	√	√	√				√
454 Pol Comp Proc	√				√		√			√	√		√	√	√					

The efficacy of the changes is being analyzed as graduates of the changed curriculum graduate.

OPAL Survey

Administered to our Freshmen in ENGR 101 for materials majors, to our sophomores in Mat E 201, all interns and co-ops and their supervisors, to our graduating seniors, and to our alumni as part of the alumni survey

IOWA STATE UNIVERSITY
COLLEGE OF ENGINEERING
EXPERIENTIAL EDUCATION ABET SURVEY WORKSHEET

Instructions: Use the scale below to rate how often you perform each action when given the opportunity. **When given the opportunity, how often does this person perform the action?**

1	**Never or almost never.** This person hardly ever performs the action.
2	**Seldom.** This person often does not perform the action.
3	**Sometimes.** This person performs the action about half of the time.
4	**Often.** This person performs the action on most occasions.
5	**Always or almost always.** This person performs the action just about every time.

No Response: No opportunity to observe.

Analysis and Judgment (ISU Accreditation Aligned)
Identifying and understanding issues, problems, and opportunities; developing the relevant criteria and comparing data from different sources to draw conclusions; using effective approaches for choosing a course of action or developing appropriate solutions; taking action that is consistent with available facts, constraints, and probable consequences.

Chooses appropriate action
Formulates clear decision criteria; evaluates options by considering implications and consequences; chooses an effective option.
1 2 3 4 5 No Response

Commits to action
Makes decisions within a reasonable time.
1 2 3 4 5 No Response

Gathers information
Identifies the need for and collects information to better understand issues, problems, and opportunities.
1 2 3 4 5 No Response

Generates alternatives
Creates relevant options for addressing problems/opportunities and achieving desired outcomes.
1 2 3 4 5 No Response

Identifies issues, problems, and opportunities
Recognizes issues, problems, or opportunities and determines whether action is needed.
1 2 3 4 5 No Response

Interprets information
Integrates information from a variety of sources; detects trends, associations, and cause-effect relationships.
1 2 3 4 5 No Response

Involves others
Includes others in the decision-making process as warranted to obtain good information, make the most appropriate decisions, and ensure buy-in and understanding of the resulting decisions.
1 2 3 4 5 No Response

Values diversity
Embraces and values diverse collection of inputs, values, perspectives, and thought paradigms in approaching the application of engineering to products and processes.
1 2 3 4 5 No Response

Communication (ISU Accreditation Aligned)
Clearly conveying information and ideas through a variety of media to individuals or groups in a manner that engages the audience and helps them understand and retain the message.

Adheres to accepted conventions
Uses syntax, pace, volume, diction, and mechanics appropriate to the media being used.
1 2 3 4 5 No Response
Adjusts to the audience
Frames message in line with audience experience, background, and expectations; uses terms, examples, and analogies that are meaningful to the audience.
1 2 3 4 5 No Response
Comprehends communication from others
Attends to messages from others; correctly interprets messages and responds appropriately.
1 2 3 4 5 No Response
Ensures understanding
Seeks input from audience; checks understanding; presents message in different ways to enhance understanding.
1 2 3 4 5 No Response
Maintains audience attention
Keeps the audience engaged through use of techniques such as analogies, illustrations, body language, and voice inflection.
1 2 3 4 5 No Response
Organizes the communication
Clarifies purpose and importance; stresses major points; follows a logical sequence.
1 2 3 4 5 No Response

Continuous Learning (ISU Accreditation Aligned)
Actively identifying new areas for learning; regularly creating and taking advantage of learning opportunities; using newly gained knowledge and skill on the job and learning through their application.
Applies knowledge or skill
Puts new knowledge, understanding, or skill to practical use on the job; furthers learning through trial and error.
1 2 3 4 5 No Response
Maximizes learning
Actively participates in learning activities in a way that makes the most of the learning experience (e.g., takes notes, asks questions, critically analyzes information, keeps on-the-job application in mind, does required tasks).
1 2 3 4 5 No Response
Seeks learning activities
Identifies and participates in appropriate learning activities (e.g., courses, reading, self-study, coaching, experiential learning) that help fulfill learning needs.
1 2 3 4 5 No Response
Takes risks in learning
Puts self in unfamiliar or uncomfortable situation in order to learn; asks questions at the risk of appearing foolish; takes on challenging or unfamiliar assignments.
1 2 3 4 5 No Response
Targets learning needs
Seeks and uses feedback and other sources of information to identify appropriate areas for learning.
1 2 3 4 5 No Response

Cultural Adaptability (ISU Accreditation Aligned)
Being open to and making changes to accommodate the differences found in other cultures in order to interact effectively with individuals and groups from a different cultural background.
Adapts behavior to other culture
Adjusts own approach to interactions, communications, and decision making to be appropriate and effective within another culture without sacrificing own values.
1 2 3 4 5 No Response
Adapts products and processes to cultural concerns
Identifies, understands and incorporates cultural factors into the design of products and processes.
1 2 3 4 5 No Response
Demonstrates inclusive behavior
Establishes effective relationships with people of other cultures and backgrounds; shows genuine acceptance of people from backgrounds different from one's own.
1 2 3 4 5 No Response
Exhibits sensitivity
Exhibits sensitivity to and respect for the perspectives and interests of people of a different culture; attends to and tries to understand different perspectives and approaches.

1 2 3 4 5 No Response

Customer Focus (ISU Accreditation Aligned)
Making customers and their needs a primary focus of one's actions; developing and sustaining productive customer relationships.
Builds collaborative relationships
Builds rapport and cooperative relationships with customers.
1 2 3 4 5 No Response
Educates customers
Shares information with customers to build their understanding of issues and capabilities.
1 2 3 4 5 No Response
Seeks to understand customers
Actively seeks information to understand customers' circumstances, problems, expectations, and needs.
1 2 3 4 5 No Response
Sets up customer feedback systems
Implements effective ways to monitor and evaluate customer concerns, issues, and satisfaction and to anticipate customer needs.
1 2 3 4 5 No Response
Takes action to meet customer needs and concerns
Considers how actions or plans will affect customers; responds quickly to meet customer needs and resolve problems; avoids overcommitments.
1 2 3 4 5 No Response

Engineering Knowledge (ISU Accreditation Aligned)
Having achieved a satisfactory level of knowledge in the relevant specialty areas of mathematics, science and engineering.
Knowledge of current engineering tools
Demonstrates a knowledge of the use of contemporary tools needed to practice engineering in an effective manner.
1 2 3 4 5 No Response
Knowledge of engineering
Demonstrates a knowledge of engineering principles required to practice in one's specialty area.
1 2 3 4 5 No Response
Knowledge of experimental design and analysis
Demonstrates a knowledge of the principles of experimental design and data analysis in one's specialty area.
1 2 3 4 5 No Response
Knowledge of mathematics
Demonstrates a knowledge of the mathematical principles required to practice engineering in one's specialty area.
1 2 3 4 5 No Response
Knowledge of science
Demonstrates a knowledge of the scientific principles required to practice engineering in one's specialty area.
1 2 3 4 5 No Response

General Knowledge (ISU Accreditation Aligned)
Having achieved a satisfactory level of knowledge outside the areas of mathematics, science and engineering.
General knowledge
Demonstrates a knowledge of important current issues and events outside the areas of mathematics, science and of engineering.
1 2 3 4 5 No Response
Relates general knowledge to engineering
Demonstrates a knowledge of the interrelationships between important issues and events outside of engineering and one's engineering specialty area.
1 2 3 4 5 No Response

Initiative (ISU Accreditation Aligned)
Taking prompt action to accomplish objectives; taking action to achieve goals beyond what is required; being

proactive.

Goes above and beyond
Takes action that goes beyond job requirements in order to achieve objectives.
1 2 3 4 5 No Response

Responds quickly
Takes immediate action when confronted with a problem or when made aware of a situation.
1 2 3 4 5 No Response

Takes independent action
Implements new ideas or potential solutions without prompting; does not wait for others to take action or to request action.
1 2 3 4 5 No Response

Innovation (ISU Accreditation Aligned)
Generating creative, non-traditional engineering solutions in work situations; trying different and novel ways to deal with work problems and opportunities.

Challenges paradigms
Identifies implicit assumptions in the way problems or situations are defined or presented; sees alternative ways to view or define problems; is not constrained by the thoughts or approaches of others.
1 2 3 4 5 No Response

Ensures relevance
Targets important areas for innovation and develops solutions that address meaningful work issues.
1 2 3 4 5 No Response

Evaluates multiple solutions
Examines numerous potential solutions and evaluates each before accepting any.
1 2 3 4 5 No Response

Leverages diverse resources
Draws upon multiple and diverse sources (individuals, disciplines, bodies of knowledge) for ideas and inspiration.
1 2 3 4 5 No Response

Thinks expansively
Combines ideas in unique ways or makes connections between disparate ideas; explores different lines of thought; views situations from multiple perspectives; brainstorms multiple approaches/solutions.
1 2 3 4 5 No Response

Integrity (ISU Accreditation Aligned)
Maintaining social, ethical, and organizational norms; firmly adhering to codes of conduct and professional ethical principles.

Behaves consistently
Ensures that words and actions are consistent; behaves consistently across situations.
1 2 3 4 5 No Response

Demonstrates honesty
Deals with people in an honest and forthright manner; represents information and data accurately and completely.
1 2 3 4 5 No Response

Keeps commitments
Performs actions as promised; does not share confidential information.
1 2 3 4 5 No Response

Planning (ISU Accreditation Aligned)
Effectively managing one's time and resources to ensure that work is completed efficiently.

Leverages resources
Takes advantage of available resources (individuals, processes, departments, and tools) to complete work efficiently.
1 2 3 4 5 No Response

Makes preparations
Ensures that required equipment and/or materials are in appropriate locations so that own and others' work can be done effectively.
1 2 3 4 5 No Response

Prioritizes
Identifies more critical and less critical activities and tasks; adjusts priorities when appropriate.
1 2 3 4 5 No Response

Schedules
Effectively allocates own time to complete work; coordinates own and others' schedules to avoid conflicts.
1 2 3 4 5 No Response
Stays focused
Uses time effectively and prevents irrelevant issues or distractions from interfering with work completion.
1 2 3 4 5 No Response

Professional Impact (ISU Accreditation Aligned)
Creating a good first impression; commanding attention and respect; showing an air of confidence.
Displays professional demeanor
Exhibits a calm appearance; does not appear nervous or overly anxious; responds openly and warmly when appropriate.
1 2 3 4 5 No Response
Dresses appropriately
Maintains a professional, businesslike image consistant with the workplace environment.
1 2 3 4 5 No Response
Speaks confidently
Speaks with a self-assured tone of voice.
1 2 3 4 5 No Response

Quality Orientation (ISU Accreditation Aligned)
Accomplishing tasks by considering all areas involved, no matter how small; showing concern for all aspects of the job; accurately checking processes and tasks; being watchful over a period of time.
Ensures high-quality output
Vigilantly watches over job processes, tasks, and work products to ensure freedom from errors, omissions, or defects.
1 2 3 4 5 No Response
Follows procedures
Accurately and carefully follows established procedures for completing work tasks.
1 2 3 4 5 No Response
Takes action
Initiates action to correct quality problems or notifies others of quality issues as appropriate.
1 2 3 4 5 No Response

Teamwork (ISU Accreditation Aligned)
Effectively participating as a member of a team to move the team toward the completion of goals.
Facilitates goal accomplishment
Makes procedural or process suggestions for achieving team goals or performing team functions; provides necessary resources or helps to remove obstacles to help the team accomplish its goals.
1 2 3 4 5 No Response
Informs others on team
Shares important or relevant information with the team.
1 2 3 4 5 No Response
Involves others
Listens to and fully involves others in team decisions and actions; values and uses individual differences and talents.
1 2 3 4 5 No Response
Models commitment
Adheres to the team's expectations and guidelines; fulfills team responsibilities; demonstrates personal commitment to the team.
1 2 3 4 5 No Response

Safety Awareness
Identifying and correcting conditions that affect employee safety; upholding safety standards.
Identifies safety issues and problems.
Detects hazardous working conditions and safety problems; checks equipment and/or work area regularly.
1 2 3 4 5 No Response
Takes corrective action
Reports or corrects unsafe working conditions; makes recommendations and/or improves safety and security

procedures; enforces safety regulations and procedures.

1 2 3 4 5 No Response

Monitors the corrective action

Monitors safety or security issues after taking corrective action and ensures continued compliance.

1 2 3 4 5 No Response

Mat E Alumni Survey:

Alumni fill out the following survey online and also are given a link to fill out the same OPAL survey used for interns and co-ops.

First Name
MI
Last Name
Email

What is your current work setting? *
[picklist-multi]
Work Setting: Specify Other if not listed above.

If you had a professional experience in engineering prior to graduation (co-op or internship), how important was that experience to success in your professional career?
Not Important
Somewhat Important
Important
Very Important

If you had an international experience in engineering prior to graduation, how important was that experience to success in your professional career?
Not Important
Somewhat Important
Important
Very Important

If you had a research experience in engineering prior to graduation, how important was that experience to success in your professional career?
Not Important
Somewhat Important
Important
Very Important

In terms of your preparation for professional practice, what went well in your undergraduate engineering program of study at ISU? (Comment)

In terms of your preparation for professional practice, what needed to be changed in your undergraduate engineering program of study at ISU? (Comment)

What two courses within your major contributed most to success in your professional career? (Comment)

With regard to professional licensure:

A. I took the Fundamentals of Engineering exam
Yes
No
B. I passed the Fundamentals of Engineering exam
Yes
No
C. I plan to pursue licensure as a Professional Engineer
Yes
No
Maybe

Have you taken courses towards, or completed another degree since you completed your bachelor's degree?

A. Taken course towards another bachelor's degree
Yes
No
......If yes, have you completed the degree?
Yes
No
B. Taken courses towards a Master's degree?
Yes
No
.....If yes, have you completed your Master's degree?
Yes
No
C: Taken courses towards a Ph.D. degree?
Yes
No
.....If yes, have you completed your Ph.D. degree?
Yes
No

To what degree have you attained the following:

Practiced materials engineering in industries such as materials production, semiconductors, medical/environmental, consumer products, and transportation products

Not at all
Somewhat
Adequately
Well

Responded to environmental, social, political, ethical and economic constraints to improve the quality of life in Iowa and the world
Not at all
Somewhat
Adequately
Well

Worked independently and in teams, and proficient in written, oral and graphical communication
Not at all
Somewhat
Adequately
Well

Engaged in lifelong learning in response to the rapidly expanding knowledge base and changing environment of our world
Not at all
Somewhat
Adequately
Well

Engaged in advanced study in materials and related or complementary fields
Not at all
Somewhat
Adequately
Well

To what degree did the materials engineering curriculum at Iowa State prepare you to:

Practice materials engineering in industries such as materials production, semiconductors, medical/environmental, consumer products, and transportation products
Not prepared
Somewhat prepared
Prepared
Well prepared

Respond to environmental, social, political, ethical and economic constraints to improve the quality of life in Iowa and the world
Not prepared
Somewhat prepared

Prepared
Well prepared

Work independently and in teams, and be proficient in written, oral and graphical communication
Not prepared
Somewhat prepared
Prepared
Well prepared

Engage in lifelong learning in response to the rapidly expanding knowledge base and changing environment of our world
Not prepared
Somewhat prepared
Prepared
Well prepared

Engage in advanced study in materials and related or complementary fields
Not prepared
Somewhat prepared
Prepared
Well prepared

To what degree are the following necessary in your career?

Practicing materials engineering in industries such as materials production, semiconductors, medical/environmental, consumer products, and transportation products
Unnecessary
Useful, but not necessary
Necessary
Very necessary

Responding to environmental, social, political, ethical and economic constraints to improve the quality of life in Iowa and the world
Unnecessary
Useful, but not necessary
Necessary
Very necessary

Working independently and in teams, and being proficient in written, oral and graphical communication
Unnecessary
Useful, but not necessary
Necessary
Very necessary

Engaging in lifelong learning in response to the rapidly expanding knowledge base and changing environment of our world
Unnecessary
Useful, but not necessary
Necessary
Very necessary

Engaging in advanced study in materials and related or complementary fields
Unnecessary
Useful, but not necessary
Necessary
Very necessary

CRITERION 5. CURRICULUM

A. Program Curriculum

Tables contained in 5-1 summarize the curriculum, including our materials core and the six options students have by choosing two of four possible specialties.

Table 5-1.1 Curriculum

Materials Engineering
Specialties: Ceramics and Metals

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) Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Other	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]
FIRST TERM							
Math165, Calculus I	R	4				F11,S12	38
ENGR160, Engineering Problems with Computer Applications Lab	R		3			F11,S12	36
ENGR101, Engineering Orientation	R	0				F10,F11	30
Eng150, Critical Thinking and Communication	R			3		F11,S12	26
Chem177, General Chemistry I	R	4				F11,S12	24 Recit., 300 Lecture
Chem177L, Laboratory in General Chemistry I	R	1				F11,S12	20
Lib160, Library Instruction	R			1		F11,S12	60
SECOND TERM							
Math166, Calculus II	R	4				F11,S12	32
Chem178, General Chemistry II	R	3				F11,S12	24 Recit., 300 Lecture
Chem178L, Laboratory in General Chemistry II	R	1				F11,S12	20
Gen Ed Elec	E			3			
Gen Ed Elec	E			3			
Gen Ed Elec	E			3			
THIRD TERM							

Math265, Calculus III	R	4				F11,S12	38
MatE201, Materials Science and Engineering - Professional Planning	R		0			F10,F11	47
MatE215, Introduction to Materials Science and Engineering I	R		3			F10,F11	43
MatE215L, Introduction to Materials Science and Engineering I - Lab	R		1			F10,F11	14
Phys221, Introduction to Classical Physics I	R	5				F11,S12	28
Eng250, Written, Oral, Visual, and Electronic Composition	R			3		F11,S12	26
FOURTH TERM							
Math267, Elementary Differential Equations and Laplace Transforms	R	4				F11,S12	38
MatE214, Structural Characterization of Materials	R		3			S11,S12	42, 14 lab
MatE216, Introduction to Materials Science and Engineering II	R		4			S11,S12	42, 14 lab
Phys222, Introduction to Classical Physics II	R	5				F10,S11	36
FIFTH TERM							
MatE311, Thermodynamics in Materials Engineering	R		3			F10,F11	47
MatE317, Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials	R		3			F10,F11	48
EM274, Statics of Engineering	R		3			F11,S12	80
Spec I: MatE321, Introduction to Ceramic Science	SE		3			F10,F11	28
SIXTH TERM							
MatE314, Kinetics and Phase Equilibria in Materials	R		3			S11,S12	43
MatE316, Computational Methods in Materials	R		3			S11,S12	41
EM324, Mechanics of Materials	R		3			F11,S12	90
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec I: MatE322, Introduction to Ceramic Processing	SE		3			S11,S12	23, 11 lab
Spec II: MatE342, Structure/Property Relations in Nonferrous Metals	SE		3			S11,S12	37
SEVENTH TERM							
MatE413, Materials Design and Professional Practice I	R		3(√)			F10,F11	41
Tech Elec	E				3		
Free Elec	E				3		
Spec I: MatE425, Glasses and Advanced Ceramics	SE		3			F10,F11	20
Spec II: MatE443, Physical Metallurgy of Ferrous Alloys	SE		3			F10,F11	32
EIGTH TERM							

MatE414, Materials Design and Professional Practice II	R		3(√)			S11,S12	37
MatE418, Mechanical Behavior of Materials	R		3			S11,S12	37
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec II: MatE444, Corrosion and Failure Analysis	SE		3			S11,S12	24, 12 lab
Add rows as needed to show all courses in the curriculum.							
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		35	59[3]	22[4]	12[5]		
OVERALL TOTAL CREDIT HOURS FOR THE DEGREE	128						
PERCENT OF TOTAL		27.3%	46.1%	17.2%	9.4%		
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.
3. (program note) Each student takes two specialties and each specialty totals 9 credits. Since the two specialties are elected by the student, the SE designator has been used here although, once a specialty is selected, those 9 credits are required.
4. (program note) Some of the 15 Gen Ed Electives may be lower level sciences (freshman or sophomore level)
5. (program note) 9 technical elective credits will be either Math & Basic Sciences or Engineering Topics, but listed here as other. 3 free elective credits may fit in any category.

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

Table 5-1.2 Curriculum

Materials Engineering
Specialties: Ceramics and Polymers

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)* Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Other	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]
FIRST TERM							
Math165, Calculus I	R	4				F11,S12	38
ENGR160, Engineering Problems with Computer Applications Lab	R		3			F11,S12	36
ENGR101, Engineering Orientation	R	0				F10,F11	30
Eng150, Critical Thinking and Communication	R			3		F11,S12	26
Chem177, General Chemistry I	R	4				F11,S12	24 Recit., 300 Lecture
Chem177L, Laboratory in General Chemistry I	R	1				F11,S12	20
Lib160, Library Instruction	R			1		F11,S12	60
SECOND TERM							
Math166, Calculus II	R	4				F11,S12	32
Chem178, General Chemistry II	R	3				F11,S12	24 Recit., 300 Lecture
Chem178L, Laboratory in General Chemistry II	R	1				F11,S12	20
Gen Ed Elec	E			3			
Gen Ed Elec	E			3			
Gen Ed Elec	E			3			
THIRD TERM							

Math265, Calculus III	R	4				F11,S12	38
MatE201, Materials Science and Engineering - Professional Planning	R		0			F10,F11	47
MatE215, Introduction to Materials Science and Engineering I	R		3			F10,F11	43
MatE215L, Introduction to Materials Science and Engineering I - Lab	R		1			F10,F11	14
Phys221, Introduction to Classical Physics I	R	5				F11,S12	28
Eng250, Written, Oral, Visual, and Electronic Composition	R			3		F11,S12	26
FOURTH TERM							
Math267, Elementary Differential Equations and Laplace Transforms	R	4				F11,S12	38
MatE214, Structural Characterization of Materials	R		3			S11,S12	42, 14 lab
MatE216, Introduction to Materials Science and Engineering II	R		4			S11,S12	42, 14 lab
Phys222, Introduction to Classical Physics II	R	5				F10,S11	36
FIFTH TERM							
MatE311, Thermodynamics in Materials Engineering	R		3			F10,F11	47
MatE317, Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials	R		3			F10,F11	48
EM274, Statics of Engineering	R		3			F11,S12	80
Spec I: MatE321, Introduction to Ceramic Science	SE		3			F10,F11	28
Spec II: MatE351, Introduction to Polymeric Materials	SE		3			F10,F11	45
SIXTH TERM							
MatE314, Kinetics and Phase Equilibria in Materials	R		3			S11,S12	43
MatE316, Computational Methods in Materials	R		3			S11,S12	41
EM324, Mechanics of Materials	R		3			F11,S12	90
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec I: MatE322, Introduction to Ceramic Processing	SE		3			S11,S12	23, 11 lab
SEVENTH TERM							
MatE413, Materials Design and Professional Practice I	R		3(√)			F10,F11	41
Tech Elec	E				3		
Free Elec	E				3		
Spec I: MatE425, Glasses and Advanced Ceramics	SE		3			F10,F11	20
Spec II: MatE453, Physical and Mechanical Properties of Polymers	SE		3			F10,F11	24
EIGTH TERM							

MatE414, Materials Design and Professional Practice II	R		3(√)			S11,S12	37
MatE418, Mechanical Behavior of Materials	R		3			S11,S12	37
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec II: MatE454, Polymer Composites and Processing	SE		3			S11,S12	21
Add rows as needed to show all courses in the curriculum.							
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		35	59[3]	22[4]	12[5]		
OVERALL TOTAL CREDIT HOURS FOR THE DEGREE	128						
PERCENT OF TOTAL		27.3%	46.1%	17.2%	9.4%		
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.
3. (program note) Each student takes two specialties and each specialty totals 9 credits. Since the two specialties are elected by the student, the SE designator has been used here although, once a specialty is selected, those 9 credits are required.
4. (program note) Some of the 15 Gen Ed Electives may be lower level sciences (freshman or sophomore level)
5. (program note) 9 technical elective credits will be either Math & Basic Sciences or Engineering Topics, but listed here as other. 3 free elective credits may fit in any category.

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

Table 5-1.3 Curriculum

Materials Engineering
Specialties: Ceramics and Electronic Materials

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)* Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Other	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]
FIRST TERM							
Math165, Calculus I	R	4				F11,S12	38
ENGR160, Engineering Problems with Computer Applications Lab	R		3			F11,S12	36
ENGR101, Engineering Orientation	R	0				F10,F11	30
Eng150, Critical Thinking and Communication	R			3		F11,S12	26
Chem177, General Chemistry I	R	4				F11,S12	24 Recit., 300 Lecture
Chem177L, Laboratory in General Chemistry I	R	1				F11,S12	20
Lib160, Library Instruction	R			1		F11,S12	60
SECOND TERM							
Math166, Calculus II	R	4				F11,S12	32
Chem178, General Chemistry II	R	3				F11,S12	24 Recit., 300 Lecture
Chem178L, Laboratory in General Chemistry II	R	1				F11,S12	20
Gen Ed Elec	E			3			
Gen Ed Elec	E			3			

Gen Ed Elec	E			3			
THIRD TERM							
Math265, Calculus III	R	4				F11,S12	38
MatE201, Materials Science and Engineering - Professional Planning	R		0			F10,F11	47
MatE215, Introduction to Materials Science and Engineering I	R		3			F10,F11	43
MatE215L, Introduction to Materials Science and Engineering I - Lab	R		1			F10,F11	14
Phys221, Introduction to Classical Physics I	R	5				F11,S12	28
Eng250, Written, Oral, Visual, and Electronic Composition	R			3		F11,S12	26
FOURTH TERM							
Math267, Elementary Differential Equations and Laplace Transforms	R	4				F11,S12	38
MatE214, Structural Characterization of Materials	R		3			S11,S12	42, 14 lab
MatE216, Introduction to Materials Science and Engineering II	R		4			S11,S12	42, 14 lab
Phys222, Introduction to Classical Physics II	R	5				F10,S11	36
FIFTH TERM							
MatE311, Thermodynamics in Materials Engineering	R		3			F10,F11	47
MatE317, Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials	R		3			F10,F11	48
EM274, Statics of Engineering	R		3			F11,S12	80
Spec I: MatE321, Introduction to Ceramic Science	SE		3			F10,F11	28
SIXTH TERM							
MatE314, Kinetics and Phase Equilibria in Materials	R		3			S11,S12	43
MatE316, Computational Methods in Materials	R		3			S11,S12	41
EM324, Mechanics of Materials	R		3			F11,S12	90
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec I: MatE322, Introduction to Ceramic Processing	SE		3			S11,S12	23, 11 lab
Spec II: MatE334, Electronic Properties of Materials	SE		3			S11,S12	17
SEVENTH TERM							
MatE413, Materials Design and Professional Practice I	R		3(√)			F10,F11	41
Tech Elec	E				3		
Free Elec	E				3		
Spec I: MatE425, Glasses and Advanced Ceramics	SE		3			F10,F11	20

Spec II: MatE433, Advanced Electronic Materials	SE		3			F10,F11	15
EIGTH TERM							
MatE414, Materials Design and Professional Practice II	R		3(√)			S11,S12	37
MatE418, Mechanical Behavior of Materials	R		3			S11,S12	37
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec II: MatE332, Semiconductor Materials and Devices	SE		3			F11,S12	16
Add rows as needed to show all courses in the curriculum.							
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		35	59[3]	22[4]	12[5]		
OVERALL TOTAL CREDIT HOURS FOR THE DEGREE	128						
PERCENT OF TOTAL		27.3%	46.1%	17.2%	9.4%		
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.
3. (program note) Each student takes two specialties and each specialty totals 9 credits. Since the two specialties are elected by the student, the SE designator has been used here although, once a specialty is selected, those 9 credits are required.
4. (program note) Some of the 15 Gen Ed Electives may be lower level sciences (freshman or sophomore level)
5. (program note) 9 technical elective credits will be either Math & Basic Sciences or Engineering Topics, but listed here as other. 3 free elective credits may fit in any category.

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

Table 5-1.4 Curriculum

Materials Engineering
Specialties: Metals and Polymers

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)* Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Other	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]
FIRST TERM							
Math165, Calculus I	R	4				F11,S12	38
ENGR160, Engineering Problems with Computer Applications Lab	R		3			F11,S12	36
ENGR101, Engineering Orientation	R	0				F10,F11	30
Eng150, Critical Thinking and Communication	R			3		F11,S12	26
Chem177, General Chemistry I	R	4				F11,S12	24 Recit., 300 Lecture
Chem177L, Laboratory in General Chemistry I	R	1				F11,S12	20
Lib160, Library Instruction	R			1		F11,S12	60
SECOND TERM							
Math166, Calculus II	R	4				F11,S12	32
Chem178, General Chemistry II	R	3				F11,S12	24 Recit., 300 Lecture
Chem178L, Laboratory in General Chemistry II	R	1				F11,S12	20
Gen Ed Elec	E			3			

Gen Ed Elec	E			3			
Gen Ed Elec	E			3			
THIRD TERM							
Math265, Calculus III	R	4				F11,S12	38
MatE201, Materials Science and Engineering - Professional Planning	R		0			F10,F11	47
MatE215, Introduction to Materials Science and Engineering I	R		3			F10,F11	43
MatE215L, Introduction to Materials Science and Engineering I - Lab	R		1			F10,F11	14
Phys221, Introduction to Classical Physics I	R	5				F11,S12	28
Eng250, Written, Oral, Visual, and Electronic Composition	R			3		F11,S12	26
FOURTH TERM							
Math267, Elementary Differential Equations and Laplace Transforms	R	4				F11,S12	38
MatE214, Structural Characterization of Materials	R		3			S11,S12	42, 14 lab
MatE216, Introduction to Materials Science and Engineering II	R		4			S11,S12	42, 14 lab
Phys222, Introduction to Classical Physics II	R	5				F10,S11	36
FIFTH TERM							
MatE311, Thermodynamics in Materials Engineering	R		3			F10,F11	47
MatE317, Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials	R		3			F10,F11	48
EM274, Statics of Engineering	R		3			F11,S12	80
Spec I: MatE351, Introduction to Polymeric Materials	SE		3			F10,F11	45
SIXTH TERM							
MatE314, Kinetics and Phase Equilibria in Materials	R		3			S11,S12	43
MatE316, Computational Methods in Materials	R		3			S11,S12	41
EM324, Mechanics of Materials	R		3			F11,S12	90
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec II: MatE342, Structure/Property Relations in Nonferrous Metals	SE		3			S11,S12	37
SEVENTH TERM							
MatE413, Materials Design and Professional Practice I	R		3(√)			F10,F11	41
Tech Elec	E				3		
Free Elec	E				3		
Spec I: MatE453, Physical and Mechanical Properties of Polymers	SE		3			F10,F11	24

Spec II: MatE443, Physical Metallurgy of Ferrous Alloys	SE		3			F10,F11	32
EIGTH TERM							
MatE414, Materials Design and Professional Practice II	R		3(√)			S11,S12	37
MatE418, Mechanical Behavior of Materials	R		3			S11,S12	37
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec I: MatE454, Polymer Composites and Processing	SE		3			S11,S12	21
Spec II: MatE444, Corrosion and Failure Analysis	SE		3			S11,S12	24, 12 lab
Add rows as needed to show all courses in the curriculum.							
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		35	59[3]	22[4]	12[5]		
OVERALL TOTAL CREDIT HOURS FOR THE DEGREE	128						
PERCENT OF TOTAL		27.3%	46.1%	17.2%	9.4%		
Total must satisfy either credit hours or percentage: Minimum Semester Credit Hours		32 Hours	48 Hours				
Total must satisfy either credit hours or percentage: 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.
3. (program note) Each student takes two specialties and each specialty totals 9 credits. Since the two specialties are elected by the student, the SE designator has been used here although, once a specialty is selected, those 9 credits are required.
4. (program note) Some of the 15 Gen Ed Electives may be lower level sciences (freshman or sophomore level)
5. (program note) 9 technical elective credits will be either Math & Basic Sciences or Engineering Topics, but listed here as other. 3 free elective credits may fit in any category.

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

Table 5-1.5 Curriculum

Materials Engineering
Specialties: Metals and Electronic Materials

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		
FIRST TERM							
Math165, Calculus I	R	4				F11,S12	38
ENGR160, Engineering Problems with Computer Applications Lab	R		3			F11,S12	36
ENGR101, Engineering Orientation	R	0				F10,F11	30
Eng150, Critical Thinking and Communication	R			3		F11,S12	26
Chem177, General Chemistry I	R	4				F11,S12	24 Recit., 300 Lecture
Chem177L, Laboratory in General Chemistry I	R	1				F11,S12	20
Lib160, Library Instruction	R			1		F11,S12	60
SECOND TERM							
Math166, Calculus II	R	4				F11,S12	32
Chem178, General Chemistry II	R	3				F11,S12	24 Recit., 300 Lecture
Chem178L, Laboratory in General Chemistry II	R	1				F11,S12	20
Gen Ed Elec	E			3			

Gen Ed Elec	E			3			
Gen Ed Elec	E			3			
THIRD TERM							
Math265, Calculus III	R	4				F11,S12	38
MatE201, Materials Science and Engineering - Professional Planning	R		0			F10,F11	47
MatE215, Introduction to Materials Science and Engineering I	R		3			F10,F11	43
MatE215L, Introduction to Materials Science and Engineering I - Lab	R		1			F10,F11	14
Phys221, Introduction to Classical Physics I	R	5				F11,S12	28
Eng250, Written, Oral, Visual, and Electronic Composition	R			3		F11,S12	26
FOURTH TERM							
Math267, Elementary Differential Equations and Laplace Transforms	R	4				F11,S12	38
MatE214, Structural Characterization of Materials	R		3			S11,S12	42, 14 lab
MatE216, Introduction to Materials Science and Engineering II	R		4			S11,S12	42, 14 lab
Phys222, Introduction to Classical Physics II	R	5				F10,S11	36
FIFTH TERM							
MatE311, Thermodynamics in Materials Engineering	R		3			F10,F11	47
MatE317, Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials	R		3			F10,F11	48
EM274, Statics of Engineering	R		3			F11,S12	80
SIXTH TERM							
MatE314, Kinetics and Phase Equilibria in Materials	R		3			S11,S12	43
MatE316, Computational Methods in Materials	R		3			S11,S12	41
EM324, Mechanics of Materials	R		3			F11,S12	90
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec I: MatE334, Electronic Properties of Materials	SE		3			S11,S12	17
Spec II: MatE342, Structure/Property Relations in Nonferrous Metals	SE		3			S11,S12	37
SEVENTH TERM							
MatE413, Materials Design and Professional Practice I	R		3(√)			F10,F11	41
Tech Elec	E				3		
Free Elec	E				3		
Spec I: MatE433, Advanced Electronic Materials	SE		3			F10,F11	15

Spec II: MatE443, Physical Metallurgy of Ferrous Alloys	SE		3			F10,F11	32
EIGTH TERM							
MatE414, Materials Design and Professional Practice II	R		3(√)			S11,S12	37
MatE418, Mechanical Behavior of Materials	R		3			S11,S12	37
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec I: MatE332, Semiconductor Materials and Devices	SE		3			F11,S12	16
Spec II: MatE444, Corrosion and Failure Analysis	SE		3			S11,S12	24, 12 lab
Add rows as needed to show all courses in the curriculum.							
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		35	59[3]	22[4]	12[5]		
OVERALL TOTAL CREDIT HOURS FOR THE DEGREE	128						
PERCENT OF TOTAL		27.3%	46.1%	17.2%	9.4%		
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.
3. (program note) Each student takes two specialties and each specialty totals 9 credits. Since the two specialties are elected by the student, the SE designator has been used here although, once a specialty is selected, those 9 credits are required.
4. (program note) Some of the 15 Gen Ed Electives may be lower level sciences (freshman or sophomore level)
5. (program note) 9 technical elective credits will be either Math & Basic Sciences or Engineering Topics, but listed here as other. 3 free elective credits may fit in any category.

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

Table 5-1.6 Curriculum

Materials Engineering
Specialties: Polymers and Electronic Materials

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)* Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Other	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]
FIRST TERM							
Math165, Calculus I	R	4				F11,S12	38
ENGR160, Engineering Problems with Computer Applications Lab	R		3			F11,S12	36
ENGR101, Engineering Orientation	R	0				F10,F11	30
Eng150, Critical Thinking and Communication	R			3		F11,S12	26
Chem177, General Chemistry I	R	4				F11,S12	24 Recit., 300 Lecture
Chem177L, Laboratory in General Chemistry I	R	1				F11,S12	20
Lib160, Library Instruction	R			1		F11,S12	60
SECOND TERM							
Math166, Calculus II	R	4				F11,S12	32
Chem178, General Chemistry II	R	3				F11,S12	24 Recit., 300 Lecture
Chem178L, Laboratory in General Chemistry II	R	1				F11,S12	20
Gen Ed Elec	E			3			

Gen Ed Elec	E			3			
Gen Ed Elec	E			3			
THIRD TERM							
Math265, Calculus III	R	4				F11,S12	38
MatE201, Materials Science and Engineering - Professional Planning	R		0			F10,F11	47
MatE215, Introduction to Materials Science and Engineering I	R		3			F10,F11	43
MatE215L, Introduction to Materials Science and Engineering I - Lab	R		1			F10,F11	14
Phys221, Introduction to Classical Physics I	R	5				F11,S12	28
Eng250, Written, Oral, Visual, and Electronic Composition	R			3		F11,S12	26
FOURTH TERM							
Math267, Elementary Differential Equations and Laplace Transforms	R	4				F11,S12	38
MatE214, Structural Characterization of Materials	R		3			S11,S12	42, 14 lab
MatE216, Introduction to Materials Science and Engineering II	R		4			S11,S12	42, 14 lab
Phys222, Introduction to Classical Physics II	R	5				F10,S11	36
FIFTH TERM							
MatE311, Thermodynamics in Materials Engineering	R		3			F10,F11	47
MatE317, Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials	R		3			F10,F11	48
EM274, Statics of Engineering	R		3			F11,S12	80
Spec I: MatE351, Introduction to Polymeric Materials	SE		3			F10,F11	45
SIXTH TERM							
MatE314, Kinetics and Phase Equilibria in Materials	R		3			S11,S12	43
MatE316, Computational Methods in Materials	R		3			S11,S12	41
EM324, Mechanics of Materials	R		3			F11,S12	90
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec II: MatE334, Electronic Properties of Materials	SE		3			S11,S12	17
SEVENTH TERM							
MatE413, Materials Design and Professional Practice I	R		3(√)			F10,F11	41
Tech Elec	E				3		
Free Elec	E				3		

Spec I: MatE453, Physical and Mechanical Properties of Polymers	SE		3			F10,F11	24
Spec II: MatE433, Advanced Electronic Materials	SE		3			F10,F11	15
EIGTH TERM							
MatE414, Materials Design and Professional Practice II	R		3(√)			S11,S12	37
MatE418, Mechanical Behavior of Materials	R		3			S11,S12	37
Tech Elec	E				3		
Gen Ed Elec	E			3			
Spec I: MatE454, Polymer Composites and Processing	SE		3			S11,S12	21
Spec II: MatE332, Semiconductor Materials and Devices	SE		3			F11,S12	16
Add rows as needed to show all courses in the curriculum.							
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		35	59[3]	22[4]	12[5]		
OVERALL TOTAL CREDIT HOURS FOR THE DEGREE	128						
PERCENT OF TOTAL		27.3%	46.1%	17.2%	9.4%		
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.
3. (program note) Each student takes two specialties and each specialty totals 9 credits. Since the two specialties are elected by the student, the SE designator has been used here although, once a specialty is selected, those 9 credits are required.
4. (program note) Some of the 15 Gen Ed Electives may be lower level sciences (freshman or sophomore level)
5. (program note) 9 technical elective credits will be either Math & Basic Sciences or Engineering Topics, but listed here as other. 3 free elective credits may fit in any category.

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

<u>Aligning the curriculum with the program educational objectives and the student outcomes</u>

In Table 3-1 we demonstrated the way that our program educational objectives are aligned with the student outcomes. In Table 4-5 each course in our curriculum has been aligned with the student outcomes for which that course is seen to support achieving. Furthermore, the Materials Engineering Curriculum at Iowa State University has been carefully designed to strike a balance between Mathematics and Basic Sciences, Engineering Science and Engineering Design, and General Education.

Table 5-2 shows the courses in the ISU Materials Engineering curriculum sorted into three categories derived from the areas specified above. According to Criterion 5, the curriculum component must include 32 credit hours of math and basic sciences, and 48 credit hours of engineering topics. In table 5-2 it can be seen that the curriculum exceeds the criterion specifications.

Table 5-2 Credits in Materials Engineering by Area

Math, Basic Science		**Engineering Topics**		**General Educ.**	
Calculus I	4	Engr. Prob. w/VBA progr.	3	English 150	3
Calculus II	4	Engineering Statics	3	English 250	3
Calculus III	4	Mechanics of Materials	3	Library 160	1
Diff. Equations with Laplace Transforms	4	Intro to Mat. Engr. I & II	8	Gen Ed Electives	15
Gen. Chem and Lab I	5	Structural Char. Of Mat	3		
Gen. Chem and Lab II	4	Intro to Elec Mat	3		
Classical Phys. I & Lab	5	Thermo of Mat	3		
Classical Phys II &lab	5	Kinetics and Phase Eq.	3		
		Comp. Methods in Mat.	3		
		Mech Behav. of Mat.	3		
		Professional Practice (Design)	6		
		Specialization Courses	**18**		
TOTALS	35	TOTALS	59	TOTALS	22

Not listed in Table 5-2 are 9 credits of technical electives (since those courses may be either engineering or mathematics and basic sciences) and 3 credits of free electives since these may be any type of course. This makes a total of 128 credits in the program.

Figure 5-1 shows the flow of pre-requisites in the materials engineering program. Not included in this figure are the elective courses. Specialty courses and their pre-requisite ties are shown in Figure 5-2. Finally Table 5-3 shows a “typical” four year plan for all courses.

Figure 5-1 Pre-requisites in the Materials Engineering Program

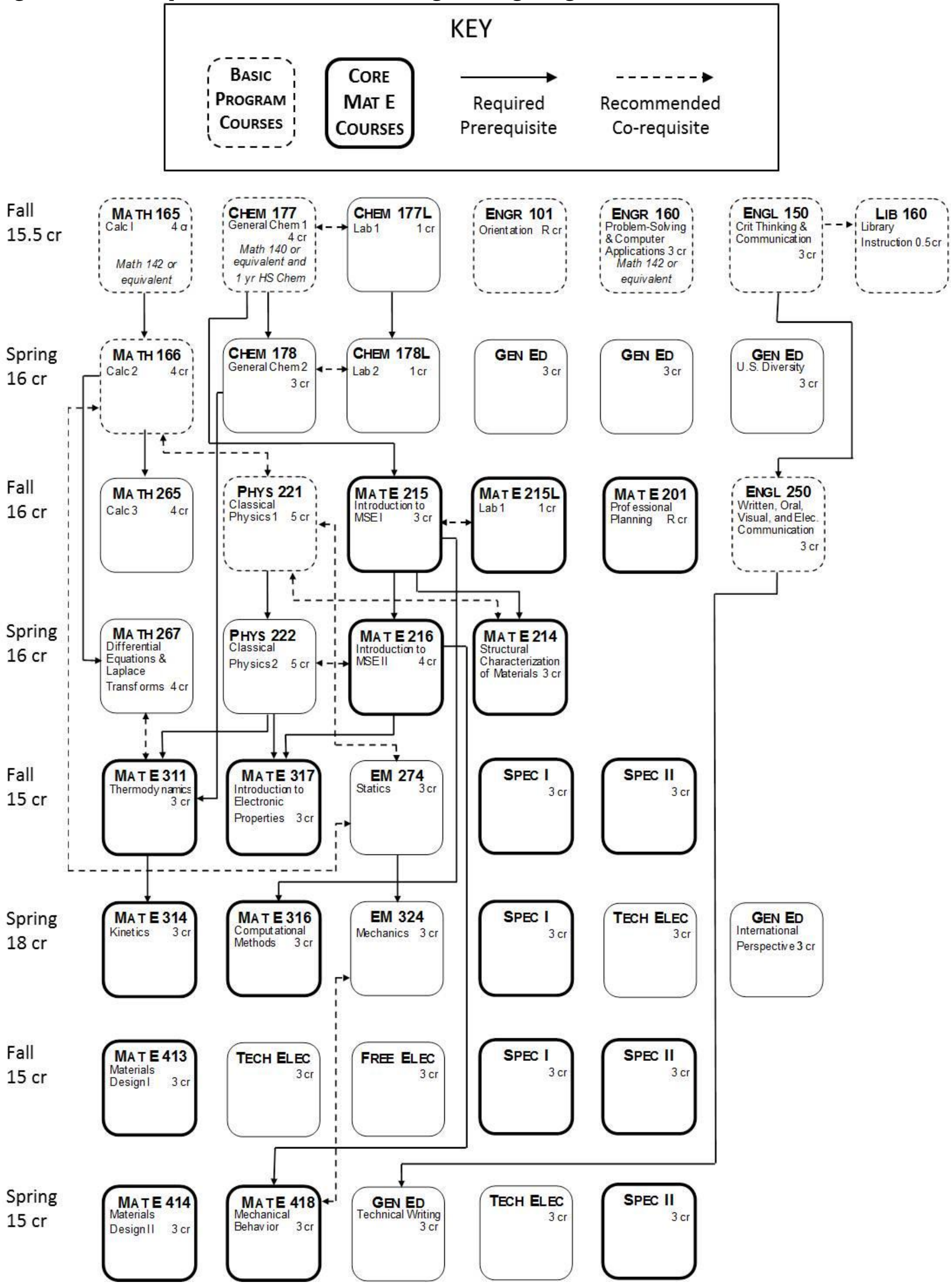


Figure 5-2 Pre-requisites in the Materials Engineering Specialty Courses

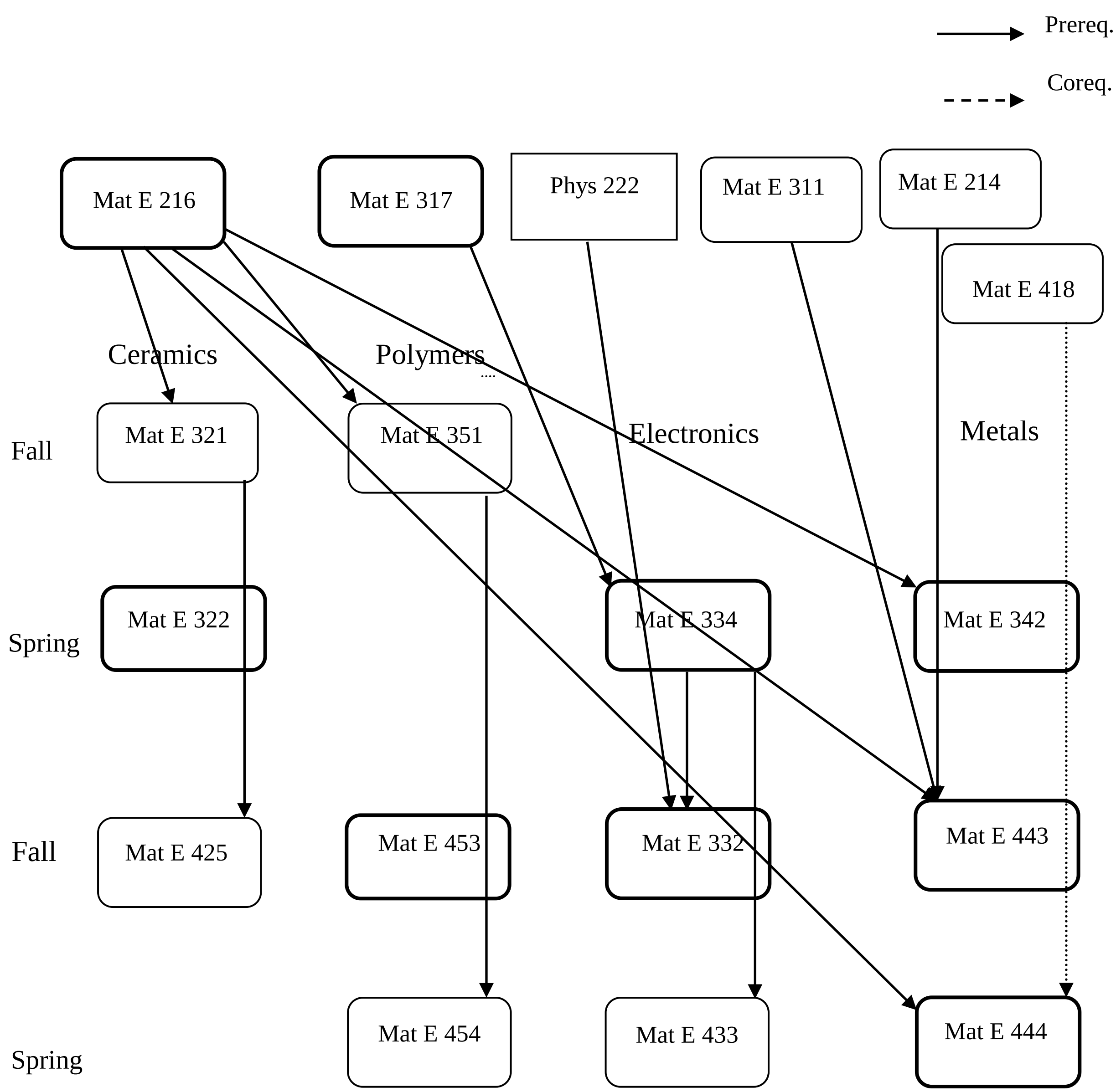


Table 5-3 The Four Year Materials Engineering Program

Freshman Year					
Semester 1	16 cr	Year taken	***Semester 2***	17 cr	Year taken
Math 165	4 cr		Math 166	4 cr	
Engr 160	3 cr		Chem 178	3 cr	
Engr 101	R cr		Chem 178L	1 cr	
English 150	3 cr		Gen Ed: ____________	3 cr	
Chem 177	4 cr		Gen Ed: ____________	3 cr	
Chem 177L	1 cr		Gen Ed: ____________ *(U.S. Diversity)*	3 cr	
Lib 160	1 cr				
			Note: You must have a 6 cr area-of emphasis in Gen Eds.		
Sophomore Year					
Semester 3	16 cr	Year taken	***Semester 4***	16 cr	Year taken
Math 265	4 cr		Math 267	4 cr	
Mat E 201	R cr		Mat E 214	3 cr	
Mat E 215	3 cr		Mat E 216	4 cr	
Mat E 215L	1 cr		Phys 222	5 cr	
Phys 221	5 cr				
English 250	3 cr				
Junior Year					
Semester 5	15 cr	Year taken	***Semester 6***	18 cr	Year taken
Mat E 311	3 cr		Mat E 314	3 cr	
Mat E 317	3 cr		Mat E 316	3 cr	
Spec. I: ____________	3 cr		Spec. I: ____________	3 cr	
Spec. II: ____________	3 cr		EM 324	3 cr	
EM 274	3 cr		Tech elec.: ____________	3 cr	
			Gen Ed: ____________	3 cr	
			(International Perspectives)	3 cr	
Senior Year					
Semester 7	15 cr	Year taken	***Semester 8***	15 cr	Year taken
Mat E 413	3 cr		Mat E 414	3 cr	
Spec. I: ____________	3 cr		Mat E 418	3 cr	
Spec. II: ____________	3 cr		Spec. II: ____________	3 cr	
Tech elec.: ____________	3 cr		Tech elec.: ____________	3 cr	
Free elec.: ____________	3 cr		Gen Ed: ____________	3 cr	
			(Technical Writing)	3 cr	

Specialization Course Sequences

(***Note***: F = offered Fall only, S = offered Spring only, F or S = offered Fall or Spring)

Ceramics	**Electronics**	**Metals**	**Polymers**
Mat E 321 (F)	Mat E 334 (S)	Mat E 342 (S)	Mat E 351 (F)
Mat E 322 (S)	Mat E 433 (F)	Mat E 443 (F)	Mat E 453 (F)
Mat E 425 (F)	Mat E 332 (F or S)	Mat E 444 (S)	Mat E 454 (S)

*Included in the 15 total Gen Ed credits is a **3 credit technical writing requirement**.
Choose one of the following courses: Engl 314, Engl 302, Engl 309, or JL MC 347

Preparation for Engineering Practice - Professional Practice and Capstone Design

The Materials Science and Engineering Department is committed to providing the student with realistic design experiences commensurate with her/his current knowledge and skills. These professional practice and design experiences are distributed through a number of courses as indicated in the course syllabi, but are concentrated in two courses. The first experience, 413 (called Materials Design and Professional Practice I), is taken in the fall semester of the senior year. In this approach to learning and practicing design, teams of students are given design problems to solve. Each member of the teams takes on a role commensurate with his/her background, experience, and skills. In these courses the process of design is discussed as well as practiced. The senior student also participates in a capstone senior design course in the spring semester, 414 (called Materials Design and Professional Practice II). In this course, our industry partners present design problems for teams of 2-4 students to work on most often in conjunction with a practicing engineer from the company and a faculty member from the department. The design team meets with industry representatives, and when possible the team visits the company and meets with engineers there to better define the problem and strategize. The course requires periodic reports (often oral) and a final oral and written (and sometimes electronic -- web pages) document presented to the faculty and industry representatives.

Co-op Education

The department does not allow cooperative education to satisfy any curricular requirements. However, cooperative work experience is highly encouraged, and students are able to register their work experience by enrolling in an internship/co-op course that provides a way to officially acknowledge this work on their transcript. Engineering Career Services coordinates the required assignments for the course, and the Associate Chair in MSE serves as the course instructor, providing guidance and support, if needed, and assigning the final grade (satisfactory/fail).

A. Additional Information

Copies of any of the assessment instruments or materials referenced in 4.A, 4.B, or 4.C must be available for review at the time of the visit. Other information such as minutes from meetings where the assessment results were evaluated and where recommendations for action were made could also be included.

Materials Available at the Time of Review

- OPAL™ notebook
    - Mat E results (cumulative and annual)
    - All engineering results (cumulative and annual)
    - Metrics used
    - Validation methods
    - Printed copy of the on-line survey
- Course portfolios
    - Course information
    - Relationship to program objectives, relationship to industry practices (if appropriate), assignments, learning activities list, grading standards.
    - Pedagogy
    - Description of teaching practices, philosophy and goals
    - Evidence of Student Learning
    - Assessment practices and tools, results, samples of student work

    - Self-reflective memo, changes to be made, professional growth related to course (papers, presentations)
- Student Transcripts
- Senior design project reports
- Copy of all survey instruments
- Compilations of all assessment data

B. Course Syllabi

Appendix A contains the required syllabi

CRITERION 6. FACULTY

A. Faculty Qualifications

The faculty of the Materials Science and Engineering Department represent a diversity of curricular and research expertise, educational and industrial backgrounds, and cultures. Appendix B provides a current summary of curriculum vitae for all faculty.

<u>Competency to Cover all Curricular Areas:</u>
The faculty qualifications are summarized in Table 6-1 and the faculty composition is summarized in Table 6-2 with respect to rank and primary and secondary area of expertise. Because most faculty are flexible in the courses they can teach, it is possible to review adequacy of faculty by considering which faculty can teach each course in the curriculum. Table 6-3 shows the depth of "coverage" for each required course in the program. Each faculty is listed as a 1^{st} preference if they are currently able to teach the course or 2^{nd} preference if they are able to teach it with some preparation.

Table 6-1. Faculty Qualifications

Name of Program: Materials Engineering

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Akinc, Mufit	Ph.D., Ceramic Engineering, 1977	P	T	FT	0	34	30		H	L	L
Anderson, Iver	Ph.D., Metallurgical Engineering	A	NTT	FT	5	23	23		H	L	L
Beckman, Scott	Ph.D., Material Science Engineering, 2005	AST	TT	FT	0	4	4		H	L	L
Bowler, Nicola	Ph.D., Physics,	ASC	TT	FT	1	8	7		H	M	M
Bratlie, Kaitlin	Ph.D., Chemistry 2007	AST	TT	FT	0	1	1		M	L	L

Cademartiri, Rebecca	Ph.D., Physical Chemistry, 2005	A	NTT	FT	0	0	0		M	M	L
Cademartiri, Ludovico	Ph.D., Interdisciplinary Chemistry, 2002	AST	TT	FT	0	0	0.25		M	L	L
Chumbley, L. Scott	Ph.D., Metallurgical Engineering,1986	P	T	FT	1/2	25	25		L	L	L
Constant, Alan	Ph.D., Materials Science and Engineering, 1987	O	NTT	FT	11	15	19		L	L	L
Constant, Kristen	Ph.D., Materials Science and Engineering, 1990	P	T	FT	0	20	20		H	M	L
Genalo, Lawrence	PhD, Applied Math, 1977	P	T	FT	5	41	41		H	M	L
Gschneidner, Karl	PhD, Physical Chemistry, 1957	P	T	PT	5	49	49		L	H	L
Jiles, David	D. Sc., Physics and Space Research, 1990	P	T	FT	0	35	28		H	H	M

Johnson, Duane	Ph.D., Physics,1985	P	T	FT	0	15	2		M	L	L
Kessler, Michael	Ph.D., Theoretical and Applied Mechanics,2002	ASC	T	FT	0	10	7	PE, State of Iowa, 6	M	L	L
King, Alexander	D. Phil., Metallurgy and Science of Materials, 1979	P	T	FT	5	30	4	(UK)	H	L	L
Kramer, Matthew	Ph.D., Geology,1988	A	NTT	FT	34	16	16		L	L	L
LeSar, Richard	Ph.D., Chemical Physics, 1981	P	T	FT	25	10	6		H	L	L
Mallapragada, Surya	Ph.D., Chemical Engineering, 1996	P	T	FT	0	18	18		H	M	L
Martin, Michael	Ph.D. Materials Science and Engineering, 1993	O	NTT	FT	1	11	10		L	M	L
Martin, Steve	Ph.D., Physical Chemistry, 1986	P	T	FT	0	26	26		H	M	H
McCallum, R. William	Ph.D., Physics,	P	NTT	FT	0	25	25		L	L	M

	1977										
Napolitano, Ralph	Ph.D., Materials Science and Engineering, 1996	P	T	FT	1	12	12		L	L	M
Pecharsky, Vitalij	Ph.D., Organic Chemistry, 1979	P	T	FT	0	33	14		L	L	L
Rajan, Krishna	Sc.D., Materials Science, 1978	P	T	FT	0	19	7		L	L	L
Russell, Alan		P	T	FT	0	35	35		L	L	M
Selby, Martha	M.S., Business Administrative Sciences, 1988	A	NTT	FT	0	29	29		L	L	L
Shechtman, Dan	Ph.D., Materials Engineering, 1972	P	T	PT	0	37	8		L	L	L
Tan, Xiaoli	PhD, MSE, 2002	ASC	T	FT	0	11	10		H	H	L
Thiel, Patricia	Ph.D., Chemistry, 1980	P	T	FT	2	29	29		H	L	L
Trivedi, Rohit	Ph.D., Metallurgy and Materials	P	T	FT	0	47	47		L	L	L

	Science, 1966										
Ustundag, Ersan	Ph.D., MSE, 1996	ASC	T	FT	0	15	8		L	L	L

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: T = Tenured TT = Tenure Track NTT = Non Tenure Track
3. Code: FT = Full-time PT = Part-time Appointment at the institution.
4. The level of activity (high, medium or low) should reflect an average over the year prior to the visit plus the two previous years.

Table 6-2 Summary of areas of expertise of the faculty

	Name	Title	Primary Area	Secondary Area
MA	Akinc, Mufit	Professor	Ceramic processing	Polymers
IA	Anderson, Iver	Adj. Prof.	Powder Metallurgy	Physical Metallurgy
SB	Beckman, Scott	Asst. Prof.	Computational Materials	Ceramics
NB	Bowler, Nicola	Assoc. Prof.	Non-Destructive Evaluation	Dielectric Properties
KB	Bratlie, Kaitlin	Asst. Prof.	Biomaterials	Characterization
RC	Cademartiri, Rebecca	Adj. Asst. Prof.	Materials Preparation and Characterization	Biology-Materials Interactions
LC	Cademartiri, Ludovico	Asst. Prof.	Materials Chemistry	Colloid Chemistry
SC	Chumbley, Scott	Professor	Metallurgy	Structural Charact., EM
AC	Constant, Alan	Senior Lecturer	Semiconductor Processing	Electronic Properties
KC	Constant, Kristen	Professor	Photonic Materials	Ceramic Processing
LG	Genalo, Larry	University Professor	Materials Education	Computational Methods
KG	Gschneidner, Karl	Distinguished Prof	Physical Metallurgy	Electronic, magnetic prop.
DJ	Jiles, David	Distinguished Prof.*	Magnetic Properties	Non-destructive evaluation
DDJ	Johnson, Duane	Professor	Computational Materials	Metallurgy
MK	Kessler, Michael	Asst. Prof.	Polymer Matrix Composites	Polymer Processing
AK	King, Alexander	Professor	Materials Characterization	Metallurgy
MJK	Kramer, Matt	Adj. Assoc. Prof.	Materials Characterization	Mechanical Properties
RL	LeSar, Richard	Professor	Computational Materials	Metallurgy
SuM	Mallapragada, Surya	Professor*	Polymer Processing	Biopolymers
MM	Martin, Michael	Senior Lecturer	Materials Characterization	Materials Processing
SM	Martin, Steve	Distinguished Prof	Glass Proc. & Characteriz.	Photonic Materials
WM	McCallum, William	Adj. Professor	Magnetic Materials	Materials Processing
RN	Napolitano, Ralph	Professor	Physical Metallurgy	Thermodynamics
VP	Pecharsky, Vitalij	Distinguished Prof	Materials Characterization	Magnetic/electronic prop.
KR	Rajan, Krishna	Professor	Materials Characterization	Computational Methods
AR	Russell, Alan	Professor	Physical Metallurgy	Processing of Alloys
MS	Selby, Martha	Adj. Asst. Prof.	Metallic Materials	Materials Education
DS	Shechtman, Dan	Professor*	Materials Characterization	Metallurgy
XT	Tan, Xiaoli	Assoc. Prof.	Electronic Materials	Materials Characterization
PT	Thiel, Patricia	Distinguished Prof.*	Surface Chemistry	Materials Chemistry
RT	Trivedi, Rohit	Distinguished Prof.	Physical Metallurgy	Thermodynamics
EU	Ustundag, Ersan	Assoc. Prof.	Micromechanics of Matls.	Materials Characterization

*Courtesy Appointment

TABLE 6-3 Teaching Capabilities of Materials Engineering Faculty

Course # and Title	1st Preference	2nd Preference
Engr. 101 Intro. to Engineering	SM, MA, KC, AC, MS	VP, LG, SC, AR
Mat E 201	KC, MS	LG, MM
Mat E 214 Structural Char. of Materials	VP, SM, SC, KR, MM	MA, AR, RT, KC
Mat E 215 Introduction to MatSE I	MA, AR, KC, AC, MM, RC	VP, SC, MS, MK, SM
Mat E 216 Introduction to MatSE II	AC, KC, AR, MK	MM, RC, LC
Mat E 311 Thermodynamics in Mat E	VP, SM, MA, RN, KR, LC, RL	RT, AC, KR
Mat E 314 Kinetics and Phase Equilibria	SB, RL, SM, MA, VP, RN, KR	RT, KC, AC
Mat E 316 Computational Methods Mat	VP, LG, RT, KR, RL	KC, AC, RN, SB
Mat E 317 Intro to Electronic Properties	AC, NB, DJ	KC
Mat E 413 Materials Design I	SM, KC, MA, MM	SC, AR, AC, KR, MS
Mat E 414 Materials Design II	SM, SC, KC, KR, MM	VP, AR, AC, MS
Mat E 418 Mechanical Behavior of Mat	XT, EU, TM, RL	SC, AR, KR
Mat E 321 Intro. to Ceramic Science	SM, KC, MA	EU, MM
Mat E 322 Intro. to Ceramic Processing	KC, MA	SM, EU
Mat E 425 Glass Sci & Adv CeramicS	SM, AC	MA, KC, EU
Mat E 334 Intro to Electronic Mat	AC, XT, NB, DJ, SuC	VP, RT, SM, KC
Mat E 332 Semiconductor Mat & Devices	AC, XT, VD*	VP, RT
Mat E 433 Advanced Electronic Materials	SM, AC, XT	VP, DJ
Mat E 342 Struc./Prop. Rel. in Metals	VP, AR, KG	SC, KR, RN
Mat E 443 Ferrous Metallurgy	RN, AR, KG	VP, SC, RT, KR
Mat E 444 Corrosion and Failure Analysis	SC, RN, KR	AR, DS, VP
Mat E 351 Intro. Polymeric Materials	MK, MM, KB, RC	SuM, MA, AC, LC
Mat E 453 Phys.&Mech. Prop. Polymers	MK, KB, RC	MK, MA, SuM
Mat E 454 Polymer Composites & Proc.	MK, KB	RC, SuM, LC

*VD: Vikram Dalal

B. Faculty Workload

All faculty have a position responsibility statement (PRS) that describes their individual expectations as to time spent on research, teaching, service, and administration. Most faculty have a research and a teaching appointment that occupies almost all of the PRS time. For such faculty two or three courses taught per year is the norm, depending upon the extent of their research load. The courses taught are from the undergraduate program, the subject of this review, or from the graduate program. Table 6-4 summarizes this data for the last academic year, the fall 2011, spring 2012, and summer 2012 semesters.

Table 6-4. Faculty Workload Summary

Name of Program: Materials 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]	
Akinc, Mufit	FT	Mat E 322/3 S12	15%	50%	35%	40%
Beckman, Scott	FT	Mat E 314/3, MSE 530/3 S12	40%	55%	5%	50%
Bowler, Nicola	FT	Mat E 362/3 S12	40%	50%	10%	50%
Bratlie, Kaitlin	FT	Mat E 351/3 F11 Mat E 456/MSE 556/3 S12	40%	55%	5%	50%
Cademartiri, Rebecca	FT	[started S12 – will teach 215L/1 F12]	20%	80%	0%	20%
Cademartiri, Ludovico	FT	[started S12 – will teach 311/3 F12]	40%	55%	6%	50%
Chumbley, L. Scott	FT	MSE 552/3 F11 Mat E 391/3, Mat E 444/3 S12	40%	50%	10%	50%
Constant, Alan	FT	Mat E 273/3 X 2, Mat E 317/3 F11 Mat E 216/3, Mat E 273/3, Mat E 334/3 S12 Mat E 273/3 Sum	90%	0%	10%	95%
Constant, Kristen	FT	Mat E 201/R, Mat E 321/3 F11	40%	30%	30%	45%

Genalo, Lawrence	FT	ENGR160H/3, Mat E 370/3, HON 302/2 F11 Mat E 316/3, Mat E 370/3, HON 322B/1 S12	50%	10%	40%	75%
Gschneidner, Karl	PT	Research only appointment	5%	85%	10%	5%
Kessler, Michael	FT	Mat E 453/3 F11, Mat E 454/3 S12 Mat E 392/3 Sum	40%	50%	10%	50%
LeSar, Richard	FT	Mat E 481/MSE 581/3 F11 TSC220/3 S12	15%	15%	70%	35%
Martin, Michael	FT	Mat E 351/3, Mat E 413/3 F11, Mat E 214/3, Mat E 414/3 S12	60%	0%	40%	80%
Martin, Steve	FT	Mat E 425/3, MSE 520/3 F11	40%	50%	10%	50%
Napolitano, Ralph	FT	Mat E 311/3, Mat E 443/3 F11	40%	50%	10%	40%
Pecharsky, Vitalij	FT	MSE 510 F11, Mat E 457X/MSE 557X/3 S12	20%	50%	30%	35%
Rajan, Krishna	FT	MSE 540/3, MSE 610/2 F11 MSE 610/2 S12	40%	50%	10%	25%
Russell, Alan	FT	Mat E 215/3 F11, Mat E 342/3 S12	40%	50%	10%	50%
Selby, Martha	FT	ENGR 160/3 X 2, Mat E 413/3 F11 ENGR 160/3, Mat E 414/3 S12	60%	0%	40%	80%
Shechtman, Dan	PT	MSE 590 TEM/2 Sum	40%	50%	10%	10%
Tan, Xiaoli	FT	Mat E 433/3 F11	40%	50%	10%	40%
Thiel, Patricia	FT	Taught in chemistry	40%	50%	10%	5%

Trivedi, Rohit	FT	Research only appointment	0%	90%	10%	5%
Ustundag, Ersan	FT	ENGR 160/3 X 2 F11, Mat E 418/3 S12	40%	50%	10%	30%

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.

C. Faculty Size

With just under 18 FTE and four adjunct faculty, the MSE department is one of the larger Materials programs in the country. In addition, a number of researchers at Ames Laboratory, the Microelectronics Research Center, and the Center for Non-destructive Evaluation provide additional materials resources to our program both in research collaboration and teaching.

Adjunct Faculty

The MSE department is uniquely placed to make use of expertise of neighboring scientists at Ames Laboratory. A number of these scientists and engineers are adjunct faculty with the department. Adjunct faculty go through the same interviewing process as tenure-track faculty prior to appointment and are subject to the same evaluation criteria after appointment. Adjunct faculty occasionally teach classes, and frequently mentor graduate and undergraduate students in the research laboratory. Adjunct faculty can attend faculty meetings and provide valuable input. They have the same voting rights as budgeted faculty except in personnel decisions and undergraduate curricular matters.

Faculty interactions with students

MSE faculty are actively engaged with students in a number of ways. Table 6-5 summarizes the involvement of faculty with students. Appendix IA summarizes the faculty workload including teaching and other responsibilities and activities.

Table 6-5 Involvement of selected faculty with students in advising, service and professional development and in interactions with industry.

Faculty	Activities
Akinc, Mufit	International Exchange Programs, Faculty Advisor for Keramos, Program coordinator for Aachen and National Tsing Hua University student exchange programs
Anderson, Iver	ASM Faculty Advisor
Beckman, Scott	Materials Math Club, MRS Student Chapter Advisor
Chumbley, Scott	International Exchange Programs, Honors Advisor, Materials Advantage faculty advisor
Constant, Alan	Curriculum Committee, Materials special topics discussion group, Graduating Seniors Open Forum
Constant, Kristen	Curriculum Committee, Faculty Advisor for Keramos, Graduating Seniors Open Forum
Genalo, Larry	Assoc. Chair for Undergrad Program, Curriculum Committee Chair, Minority student Programs, Recruiter, Honors Faculty Affiliate, Materials Math Club, Graduating Seniors Open Forum
Johnson, Duane	MSE group student advisory/discussion open forums
King, Alexander	MRS Faculty Advisor
LeSar, Richard	Department Chair (until 7/12), Materials Math Club, MSE group student advisory/discussion open forums
Martin, Michael	ISU Engineers Without Borders Faculty Advisor, ISU Bicycling Club Faculty Advisor
Martin, Steve	Gaffer's Guild Club advisor
Rajan, Krishna	MSE group student advisory/discussion open forums
Selby, Martha	Curriculum Committee, Scholarships and awards, Academic Standards Committee, Graduating Seniors Open Forum
Almost all faculty	Employ Undergraduates in Research Groups, Mentor Undergraduates in Senior Design Teams or First-Year Honors Research Projects or other similar projects

D. Professional Development

Faculty have numerous paths for professional development including Faculty Professional Development Assignments (FPDA or sabbaticals), on campus FPDA, professional workshops at conferences and on campus, more informal meetings and programs on campus with colleagues and the IAB, and research collaborations.

FPDA: Faculty can apply for FPDAs through the department, to the college, and then to the Provost's office. These sabbaticals allow faculty to perform collaborative research or scholarship at sites around the world and maintain their income and faculty status.

On-campus FPDA: Faculty can apply for a FPDA to establish a new research area by collaborating with faculty on campus in another discipline. Again the faculty member's income and status are maintained while they establish a knowledge base and research possibilities in a second discipline.

Workshops/Programs: Many conferences, both educational and research, offer workshops for attendees. Our Center for Excellence in Learning and Teaching (CELT) provides workshops on campus on various topics intended to improve the teaching ability of faculty. CELT also has programs that pair a junior faculty member with a senior "teaching partner" to help develop the skills of the junior partner. CELT will also provide a peer evaluation of teaching, in collaboration with an individual faculty member, and that evaluation may or may not be shared with the faculty member's department chair, at the discretion of the faculty member.

Research Collaborations: Of course faculty are continually providing themselves with professional development through their research collaborations both on and off campus.

E. Authority and Responsibility of Faculty

Responsibility Chart for the Materials Engineering Program

The faculty are ultimately responsible for the undergraduate program. Figure 6-1 shows how this responsibility is distributed among the faculty. The curriculum committee has overall responsibility for the program, while each specialty committee has responsibility for that portion of the program.

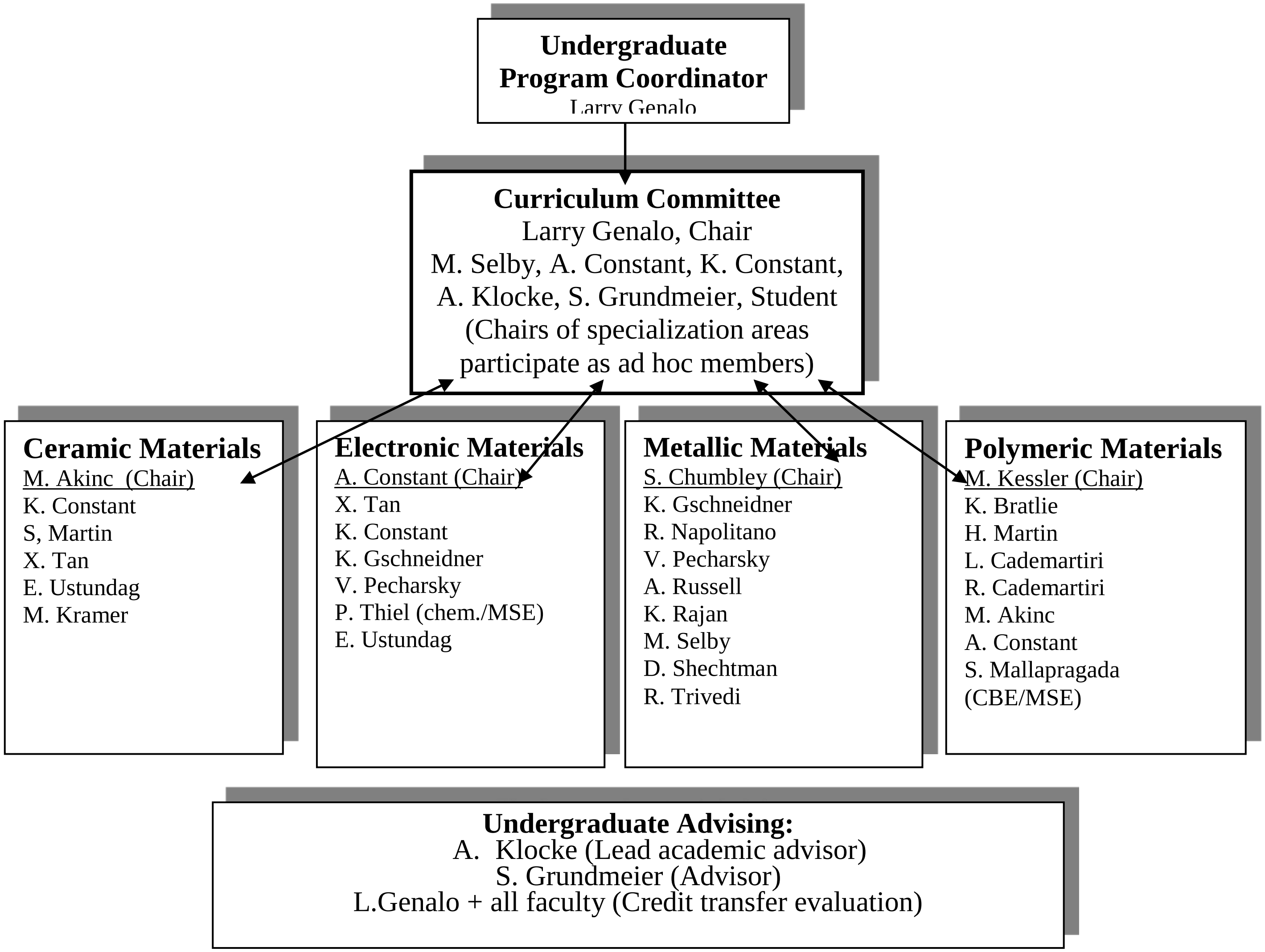


Figure 6-1 Responsibility Chart for the Undergraduate Program

Faculty Evaluation
Faculty in MSE submit a yearly self-evaluation of their performance. Additionally, faculty discuss plans for improvement in each area in which they have responsibility (as outlined by a Position Responsibility Statement). This document is used as a basis for discussion in a yearly performance coaching with the department chair. In this way the chair can monitor faculty growth and balance the needs of the department and the individual. Students do a course/instructor evaluation at the end of each course. These ratings and student comments are also part of the evaluation of the instructor, as well as being used as an evaluation of how well the course is meeting its expected outcomes.

Faculty maintain a course portfolio and add a memo at the end of each semester taught describing what went well, what didn't, and their plans for the next offering. The students also do an evaluation of the course and the instructor at the end of each course. These student ratings are not only used in the annual faculty evaluation, as stated in the paragraph above, but the students also rate the course on its ability to help them achieve selected outcomes for that course. The curriculum committee and the specialty committees review the student ratings and take corrective actions when problems arise. Such problems and corrective actions are delineated in Criterion 4 on Continuous Improvement.

Faculty are also involved in retreats at which the undergraduate program, or a portion of it, are discussed. In addition faculty meetings during the school year often are devoted to some aspect of the undergraduate program. Finally, the faculty are engaged with the Industrial Advisory Board meetings, and again the undergraduate program is discussed at each of these meetings.

The Associate Dean for Education in the College of Engineering assists programs in their continuous improvement processes by providing leadership on issues of common concern. The Associate Dean oversees the Basic Program, the Classification Office and provides funds for faculty improvement, training, and innovation in this area (e.g., travel funds to assessment conferences, the recent Dean's Education Initiative, etc.).

Engineering Career Services (ECS) provides a number of assessment services to the program.

- It implements the assessment process for students in engineering experiential education settings using OPAL™ - Online Performance and Learning (described in Criteria 4 – Continuous Improvement). On an annual basis, ECS provides programs with data of supervisor and student self-evaluation of 15 workplace competencies.
- It implements OPAL™ for student self-assessment in classes.
- It implements OPAL™ for graduate self-assessment.
- It conducts graduate surveys for the programs and summarizes the responses.
- It provides placement data to the programs each semester.

The College of Engineering ABET Committee serves as a forum for programs to share and seek information about their continuous improvement processes. Each degree program within the College has a representative on the committee which meets monthly throughout the academic year. Additionally, the Committee summarizes the results of the Fundamentals of Engineering Examinations, analyzes and distributes the data to programs.

In 2011, the program wrote a draft self-study. The College hired a consultant with significant ABET experience who reviewed the self-studies of all programs and then spent two hours face-to-face with each program reviewing their document and continuous improvement processes.

CRITERION 7. FACILITIES

A. Offices, Classrooms and Laboratories

1. Offices

The department maintains a suite of offices in 2220/2240 Hoover Hall for all faculty and the administrative functions of the department. Most classes are taught in or near Hoover Hall and these offices are used by faculty for maintaining office hours and meeting with students on course issues. In addition, faculty with research labs in Gilman Hall or the Ames Laboratory have a second office in those buildings.

2. Classrooms

The materials science and engineering department is assigned classroom space through the Office of Space and Scheduling using standard university procedures. Most department undergraduate classes are held in new classrooms in Hoover Hall or the connected Howe Hall, equipped with built in computer projectors, document cameras, and wireless internet access, which allow faculty to quickly plug in their laptops for computer-based instruction. A few classes are held in Howe Hall, which is similarly equipped. The department thus has enough general classroom space to meet all current and future needs.

3. Laboratory facilities

All of the current teaching laboratory space is consolidated in Hoover Hall (see Figure 7-1). In Hoover, dedicated laboratories exist under the following designations:

- Mechanical Properties and Thermal Analysis
- Scanning Microscopy and X-ray Diffraction
- Optical Materialography and Sample Preparation
- Thermal Processing and Heat treatment
- Polymer Processing and Properties
- Electronic Properties

Research equipment and laboratory space is sometimes utilized for teaching undergraduates, particularly in the capstone design course, or when a highly specialized experiment or demonstration is being conducted. We have found it more cost effective to let research faculty use and maintain certain pieces of equipment which are used very infrequently in undergraduates laboratories, bearing the associated costs of the equipment, rather than burden the department with continually maintaining a piece of equipment that may only be used one week out of the year.

Most laboratory space serves multiple courses due to the emphasis on hands-on laboratory classes that the department maintains. This is especially true of the first four undergraduate laboratories, which are used heavily every semester for multiple classes.

Monitoring of laboratory use over the past few years has revealed that the Electronic Properties laboratory and the Polymer Processing and Properties laboratory were underutilized. To be more efficient in use the electronic properties laboratory now also serves as a quiet student workroom, a meeting place for design groups, and as a help room for various classes and / or peer mentor meetings. As student enrollment has increased it has become a very convenient and accessible room for a number of uses.

The polymer lab continues to be under-utilized and, given the increasing request for high-quality research space, this might eventually be re-assigned, with the polymer equipment distributed elsewhere. For example, the mechanical property equipment for polymer use might be moved to the existing mechanical property lab, injection molders to Thermal Processing and Heat Treatment, etc.

The department is currently evaluating the effect on laboratory classes should the enrollment continue to increase. When the department moved to Hoover in 2004 the labs were designed to accommodate on average 20 students at a time per lab section, even though at that time average enrollment was 12-15. Section sizes are already 20+ and are expected to rise. Increased enrollment has been accommodated by allowing students access to the labs during the evening hours, staggering use of the laboratories and equipment, and by splitting formerly single sections classes into 2 or more sections. Plans to adapt equipment to allow for multi-user demonstration and instruction via installed computer projections are also being pursued.

Labs for courses taken by Mat E majors (chemistry, physics, etc.) are maintained by those departments and are appropriate for their intended use.

Laboratory Equipment

The MSE department has an excellent inventory of equipment for use in teaching classes. This equipment is inventoried yearly, and the Facilities and Equipment Committee regularly reviews needs for upgrading, repairing, replacement and new equipment. The inventory of equipment includes:

- Two variable pressure SEMs and x-ray diffraction facility
- Fully equipped materialography laboratory containing polishing equipment, computer controlled microhardness testing facilities, and 12 fully equipped student optical microscopes
- Modern heat treatment facilities covering temperatures from room T to 1500˚ C
- Extensive thermal analysis, polymer characterization, and mechanical property testing equipment.
- Equipment for electronic property measurement and non-destructive testing

Hourly or per sample fees are assessed to anyone using the equipment for research purposes. Equipment used by design is also charged an hourly rate billed to the supporting company. This, in turn, provides a fund for equipment repair, maintenance and purchase of supplies.

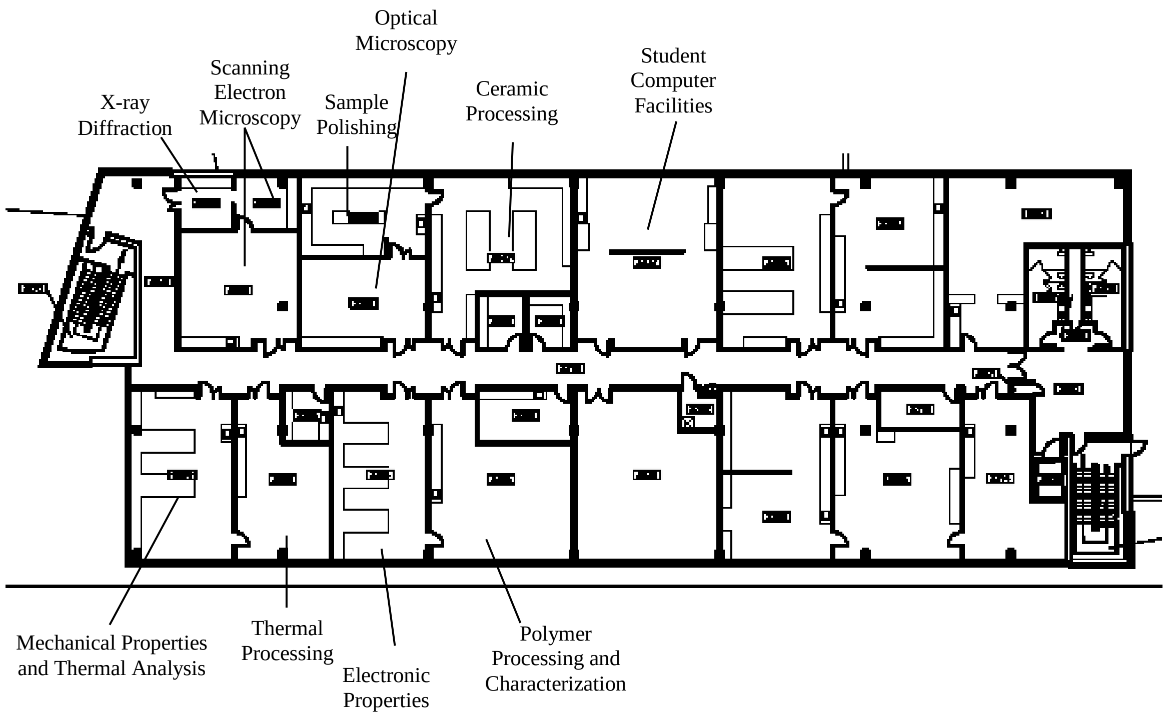


Figure 7-1 Laboratory Facilities

B. Computing Resources

The MSE department provides computing resources to students on two levels. At the first level, much of the departmental teaching equipment is controlled by computer workstations. This includes devices such as the thermal analysis equipment, x-ray diffractometer, etc. which use proprietary software packages for data acquisition and analysis, and equipment (e.g. furnaces, the Instron) where the department has developed its own computer control interface. Special computing resources in this category include the computer-based SEM teaching laboratory. As enrollment increases we hope to adapt the XRD instruction in a manner similar to what is used for the SEM.

On a second level students are provided with personal computing resources by maintaining a common student work-room. This student room is fully equipped with computers, printers, and scanners for use by all students. Specific software packages used in various MSE classes are on these computers as well as general word processing, graphing, and drawing packages. Students have access to this room 24 hours per day through a key card access system. All of the computers are linked to the engineering domain so students can access their own personal profile from any computer at any time. The building has wireless access so many students bring their own personal computers and access their files and the internet wherever they find a quiet place to sit. Due to enrollment growth a second student room with computing facilities is being planned for this summer (2012). In addition two small student team meeting rooms are being created. All four rooms are in the same vicinity in our third floor hallway. With this change the computing facilities will be adequate for our current and near future student population.

Since all of the laboratories in Hoover are fully equipped with projection systems, a large number of departmental classes have lectures and notes placed on web pages using either WebCT or Blackboard, the university supported, web-based instructional support systems. WebCT is currently being phased out in preference of Blackboard, although a number of classes still use the old system. Both packages have a number of useful features including allowing posting of notes, class discussion of topics, grades, etc. This enables the instructor to maintain communication with students outside of normal class meeting times. Web access is also possible and videos and animations are also frequently used classroom tools. The department also owns and maintains a number of stand-alone projector systems that are used heavily by students when traveling to companies involved in design projects.

The student computer room is maintained using student computer fees paid as part of their tuition. The department provides half-time salary support for a staff member of the engineering computer support services who sees that the computers are kept in working condition. Faculty and student requests are solicited each fall to ensure that the equipment and software will meet the needs of the curriculum. Laboratory computer equipment that is used for both research and teaching purposes (such as the thermal analysis equipment, XRD, SEM etc.) is maintained jointly using user fees charged to research contracts and from departmental resources.

There are many computer labs on campus, including both public labs and college and department labs. Public labs are accessible to everyone at the university, funded by the student computer fee paid by all students, and managed by the Computation Advisory Committee (CAC). College and department labs may be exclusively for members of a specific college or department. There are computer labs available in over 38 buildings on campus, including academic and residence buildings. Every College of Engineering building have multiple computer labs available for its students. Hours of availability vary by laboratory and building, but are typically from 6:00 a.m. until 11:00 p.m. A complete listing of computer facilities and resources available to students can be found at http://www.it.iastate.edu/services/labs.

Labs are available with Windows, Macintosh and Linux operating systems. All university laboratories have Microsoft Office. Engineering students have access to these programs: Ansys, Arena, Autodesk AutoCAD, Autodesk Inventor, Autodesk Mechanical Desktop, DVT Framework, JMP, Lingo, Maple, Mathcad, MathType, Matlab, Mathematica, Microsoft Project, Microsoft Publisher, Microsoft Visio, Pro/Engineer, Pro/Mechanica, RFlow, Roxio CD Creator, Solid Edge, SolidWorks, Techplot, Visual Studio .NET. Additionally, Ashby's materials selection software is available to materials engineering students and is used in our senior capstone sequence, 413 and 414, where students are instructed on its use.

C. Guidance

Students have ample opportunity to develop proficiency with a variety of modern engineering tools. The department has always stressed hands-on instruction as an important part of education, and students are required to take a large number of laboratory credits. While the actual number may vary depending upon which particular specialization path is chosen, all specializations require at least one dedicated lab class in addition to the 5 core labs required by the department. Additionally, students are exposed to laboratory work in Engr. 160, both chemistry courses, and physics courses.

D. Maintenance and Upgrading of Facilities

Computing resources and those technological tools that are in any way connected to a computer are covered under the student fee policy. Engineering students pay $ 223 per semester to maintain and build the computer/technology environment. These funds are more than adequate for the necessary computing environment and help to also maintain other lab equipment. In addition, since many of our pieces of lab equipment used in the undergraduate program are "research grade," users pay a usage fee into an instrument account that helps to maintain and upgrade the facilities.

E. Library Services

The University Library (http://www.lib.iastate.edu/) provides a wide array of print, non-print, and electronic information resources, which are housed in the main Parks Library, the e-Library, and three branch libraries (Design, Mathematics, and Veterinary Medicine). The library's extensive collections support research and study for all ISU programs, with the strongest support at the Ph.D. level. These collections are nationally recognized for their strengths in basic and applied fields of biological and physical sciences. Library holdings include more than 2,444,263 volumes and approximately 29,850 serial subscriptions.

The library encourages use of its collections and many services, and assistance is provided at seven public service desks. These desks include the Reference Desk, the Reserve and Media Services, Interlibrary Loan/Document Delivery, the Circulation Desk, the Microforms Center, Special Collections, and the Map Room. In addition, instruction in the use of library resources is offered to graduate and undergraduate students.

The library's e-Library, accessed through the Internet, provides access to the local online catalog; indexing and abstracting databases; electronic journals and books; and selected Internet sites. Assistance in using this vast body of electronic resources is available at the Reference Desk and through individually arranged appointments with reference librarians.

Each academic area in the College of Engineering has a subject librarian responsible for library collections and access that works with the departmental faculty liaison. The subject librarian is the primary contact for department/program faculty for questions and information regarding library collections, instructional support, and reference services. Their responsibilities include:

- Communicate regularly with the faculty liaison concerning acquisitions of new electronic journals, new research or teaching tools, instructional support services, and other new library initiatives.
- Collaborate with the faculty liaison to build and sustain a collection appropriate for the department/program needs.
- Consult with the faculty liaison and other academic administrators concerning future academic directions, programmatic needs, and changes in course offerings that may impact how the Library supports the department/program.
- Work closely with the faculty liaison during special projects, such as a journal cancellation project, a large purchase decision, or a major withdrawal/transfer project of bound journal volumes or books.

The library's technical collection and access to additional resources is adequate to meet the needs of the program and the faculty. The process by which faculty may request books or subscriptions is transparent, accessible and adequate. The system for locating and obtaining electronic information is adequate and supported by library professionals.

Within the department our library liaison presents frequent reports and solicits suggestions from faculty and students for additions or changes. The library facilities are adequate for the materials engineering program.

F. Overall Comments on Facilities

The MSE Department's Safety program is based upon **Training**, availability of **Personal Protective Equipment**, **Documentation**, and **Inspection**. Specific **training** is required of students before they are permitted access to the teaching laboratories. Some of the training is delivered and confirmed directly by faculty and teaching assistants, and some is delivered via online courses. The online courses are administered by the university's Environmental Health and Safety department (EH&S) – these courses contain both the relevant information and assessment of learning.

Personal Protective Equipment appropriate to the activities of each specific lab space is stocked and required for all users. Safety showers and eyewash stations are in prominent, well-marked locations and are each tested periodically. The showers and eyewash stations are tested monthly and fire extinguishers annually.

Each laboratory contains important safety **documentation** including: Standard Operating Procedures (SOPs) for each tool or device, a current chemical inventory (which is also filed with EH&S), Materials Safety Data Sheets (MSDS) for all chemicals present, posted contact information, and posted emergency action plans. With the exception of the SOPs, these documents are reviewed and updated annually.

Inspections are conducted annually by the university's EH&S unit. The checklist of issues which are investigated is on the following page. Each laboratory receives the individual attention of a safety professional who informs the Lab's Owner and the MSE department's Safety Officer of any deficiencies found in a given lab. Additionally, informal safety inspections occur on an ongoing basis by the department's safety officer.

Environmental Health and Safety
2809 Daley Drive
Ames, Iowa 50011-3660
Phone: 515 294-5359
Fax: 515-294-9357
www.ehs.iastate.edu

LABORATORY SAFETY SURVEY

DEPARTMENT: PRINCIPAL INVESTIGATOR:
BUILDING: SUPERVISOR/CONTACT:
ROOM(S): INSPECTED BY: DATE:

A. SAFETY PRACTICES YES NO NA

1. Work practices observed during the Laboratory Safety Survey were performed safely. ☐ ☐ ☐
2. Current safety training records available. ☐ ☐ ☐
3. Laboratory Safety Surveys being performed & documented annually as required in the Laboratory Safety Manual. ☐ ☐ ☐
4. Access to the laboratory is locked or restricted at all times. ☐ ☐ ☐

Comments:

B. EMERGENCY EQUIPMENT YES NO NA

1. Appropriate signage posted on hallway doors. ☐ ☐ ☐
2. Room fire extinguishers appropriate, mounted, charged, unobstructed and checked annually. ☐ ☐ ☐
3. Spill control kits available. ☐ ☐ ☐
4. Appropriate first-aid kit available. ☐ ☐ ☐
5. Eyewash stations are available and documented to be in good working condition monthly by lab personnel. ☐ ☐ ☐
6. Safety shower available within 10 seconds of laboratory using hazardous chemicals. ☐ ☐ ☐
7. Areas within 3’ of eyewash and safety shower are unobstructed. ☐ ☐ ☐

Comments:

C. CHEMICAL/BIOLOGICAL SAFETY YES NO NA

1. Current Laboratory Safety Manual/Biosafety Manual available in lab or online, as appropriate. ☐ ☐ ☐
2. Chemical/Biological inventories current and copies sent to EH&S annually. ☐ ☐ ☐
3. MSDSs for Chemical/Biological hazardous materials are available. ☐ ☐ ☐
4. Standard operating procedures (SOPs) developed for use of Chemical/Biological hazardous materials. ☐ ☐ ☐
5. Containers appropriately labeled, with names spelled out (no abbreviations, formulas or shorthand). ☐ ☐ ☐
6. Containers securely closed when not in use. ☐ ☐ ☐
7. Incompatible chemicals stored separately and all chemicals are stored by hazard category. ☐ ☐ ☐
8. Secondary containment is being used for liquid chemicals in storage cabinets. ☐ ☐ ☐
9. Appropriate shelving for liquid chemicals, specifically acids. ☐ ☐ ☐
10. Chemicals with exposure limits <50 ppm used only in fume hoods. ☐ ☐ ☐
11. Flammable liquids over 1 gallon are in approved containers. ☐ ☐ ☐
12. Flammable liquids totaling more than ten gallons are stored in flammable liquid safety cabinets. ☐ ☐ ☐
13. Peroxide formers bear a yellow Peroxide Warning Label and are properly dated. ☐ ☐ ☐
14. Peroxide formers disposed of by expiration date or tested for peroxide concentration. ☐ ☐ ☐
15. Gas cylinders secured, away from heat sources and capped when not in use. ☐ ☐ ☐

☐ ☐ ☐

16. Hazardous gases (fire & health rating 3 or 4) in ventilated cabinet.
17. Fume hoods and biosafety cabinets certified annually, properly used and not used for routine storage. ☐ ☐ ☐
18. Refrigeration equipment labeled to indicate the suitability for storing flammable liquids. ☐ ☐ ☐
19. Vacuum equipment trapped or filtered. ☐ ☐ ☐
20. Containment procedures in place for equipment containing mercury. ☐ ☐ ☐
21. Hazard Inventory Form (http://www.ehs.iastate.edu/forms/hazardinventory.pdf) submitted to EH&S. ☐ ☐ ☐

Comments:

D. HAZARDOUS WASTE MANAGEMENT PRACTICES YES NO NA

1. Lab personnel are familiar with EH&S waste collection procedures. ☐ ☐ ☐
2. Personnel utilizing the waste satellite accumulation area have annually completed Management of Unwanted Material for Laboratory Personnel. ☐ ☐ ☐
3. Waste materials are collected in a designated satellite accumulation area identified with green EH&S signage. ☐ ☐ ☐
4. Waste satellite accumulation areas are located at or near the point of generation. ☐ ☐ ☐
5. Waste containers are appropriately labeled (no abbreviations, formulas, or shorthand). ☐ ☐ ☐
6. Waste containers are closed except when in use.

Comments:

E. GENERAL SAFETY YES NO NA

1. Sink hoses from public water supply are above sink rim unless backflow device is installed on faucet. ☐ ☐ ☐
2. Suitable personal protective equipment available, in good condition, properly stored and not worn outside of the lab. ☐ ☐ ☐
3. Respirator users fit tested and trained. ☐ ☐ ☐
4. Hand washing soap and towels are available at laboratory sink. ☐ ☐ ☐
5. Areas are clean, uncluttered and all garbage is disposed of safely. ☐ ☐ ☐
6. Exits and aisles are unobstructed. ☐ ☐ ☐
7. Heavy objects and chemicals stored below five feet. ☐ ☐ ☐
8. Ladders and step stools appropriate and in good condition. ☐ ☐ ☐
9. Food, beverages, tobacco products and cosmetics are absent from working areas. ☐ ☐ ☐
10. Appropriate safety signs posted. ☐ ☐ ☐
11. Laboratory equipment moving parts guarded (i.e., fan belts). ☐ ☐ ☐
12. Fire doors are kept closed unless held open by alarm deactivating magnets. ☐ ☐ ☐
13. Illumination is adequate for all activities, avoiding reflections and glare that could affect vision. ☐ ☐ ☐
14. Emergency Action Plan posted. ☐ ☐ ☐

Comments:

F. ELECTRICAL SAFETY YES NO NA

1. Electrical equipment correctly grounded with three pronged plugs. ☐ ☐ ☐
2. Electrical cords in safe condition (no cuts, cracks or taped repairs). ☐ ☐ ☐
3. Extension cords absent. ☐ ☐ ☐
4. Multi-plug power strips are UL approved and breakered. ☐ ☐ ☐
5. No multi-plug power strips used in tandem. ☐ ☐ ☐
6. Circuit breaker panels and emergency shutoffs unobstructed (30” clear space) and unlocked. ☐ ☐ ☐
7. High wattage equipment (i.e., refrigerators, copiers, etc.) plugged directly into wall outlets. ☐ ☐ ☐

Comments:

G. SAFETY ITEMS REQUIRING FP&M ACTION YES NO NA

Note: Initiate a request for services at www.fpm.iastate.edu/forms/servicerequest (contact EH&S for assistance).

1. Building area mechanic has tested the safety shower in the past year. ☐ ☐ ☐
2. Circuit breaker panels labeled. ☐ ☐ ☐
3. Electrical outlets grounded with three-pronged receptacle. ☐ ☐ ☐
4. Electrical outlets, switches, and covers in good repair. ☐ ☐ ☐
5. Ground fault circuit interrupt outlets are labeled and operating correctly. ☐ ☐ ☐
6. Outlets within 6' of water source are GFCI protected. ☐ ☐ ☐
7. Fire separation appropriate (i.e., door, door closure, wireglass, etc.). ☐ ☐ ☐
8. Fume hoods are in good repair and functioning properly. ☐ ☐ ☐

Comments:

H. ADDITIONAL BIOSAFETY PRACTICES YES NO NA

1. Laboratory work conforms to the requirements of the Biosafety Manual. ☐ ☐ ☐
2. Work surfaces decontaminated at least once a day and after a spill of viable material. ☐ ☐ ☐
3. Autoclave performance checks completed monthly by validation spore test. ☐ ☐ ☐
4. Laboratory and furniture constructed so they can be easily cleaned and decontaminated. ☐ ☐ ☐
5. Only animals or plants associated with current study in a BSL-2 laboratory. ☐ ☐ ☐
6. Biological safety cabinets are used for processes generating aerosols & handling large quantities of infectious materials. ☐ ☐ ☐
7. Access to Select Biological Agents is restricted. ☐ ☐ ☐
8. An "X" made with autoclave tape covers biohazard symbols on red bags to indicate materials have been decontaminated. ☐ ☐ ☐

Comments:

OTHER SAFETY ISSUES

If you use BSL-3 organisms, please contact EH&S Biosafety group at 294-5359 for requirements.
If you use radioactive materials, lasers, etc., contact Radiation Safety at 294-7667 for requirements.

CRITERION 8. INSTITUTIONAL SUPPORT

A. Leadership

The program is led by the Associate Chair for Administration and Undergraduate Studies (AUS), who serves as the Director of Undergraduate Education and head of the Undergraduate Curriculum Committee (UGC).   The UGC, which consists of its chair, regular and teaching faculty members, academic advisors, and an undergraduate student representative, makes recommendations on curriculum changes to the full members of the faculty of the department, who must approve all such changes. Teaching assignments and allocations of resources are the responsibility of the Department Chair, as advised by the Associate Chair for Administration and Undergraduate Studies.   The overall management of the Department is led by the Chair and the administrative team, which consists of the Chair, the Associate chair for Administration and Undergraduate Studies, the Associate Chair for Research and Economic Development, the Department's Office Manager, and the Department's Fiscal Officer, who meet weekly and as needed.

B. Program Budget and Financial Support
Budget

Iowa State University's approach to the management of financial resources involves both local and central decision-making to meet present needs and obligations as well as to make progress on strategic planning goals. Vice presidents, deans, directors, and department chairs have the authority to plan the budget(s) of the unit(s) under their administration, and the responsibility to see that resources are used wisely and in a manner consistent with University and board policies. Each administrator is given the flexibility to respond to emerging needs or long-range goals by shifting and realigning resources within the total block of funds assigned to their particular unit, e.g., shifting resources between equipment and supplies accounts and those used for salaries.

The Resource Management Model (RMM) was implemented in July 2008. This budget model forms the core of a larger set of processes and policies that inform and shape the university's annual operating budget, referred to as the general fund. This fund's revenue sources include tuition revenues, state appropriations, and indirect cost recovery. Student fees, sponsored funding, private fundraising cash receipts, and pooled investment earnings are also pieces of the college's comprehensive budget that leverage the general fund, supporting the goals of the college.

Due to the dynamic fiscal environment in higher public education, this budget model links responsibilities with resource decisions and provides a more effective way to accomplish the goals of the university's strategic plan. The model has undergone a university-wide review. The formulaic component of the RMM will be modified in some ways, beginning with July 2013.

The College of Engineering Dean determines the Engineering budget within the context of the university and makes plans for its educational, research, and extension programs.

The highest priority is the quality of the student learning experiences. The College is well positioned to respond to the resource fluctuations and customer needs for this year and beyond by having taken steps to implement a leaner, more efficient, and more collaborative administrative structure and business model.

The intention and philosophy of the college is to improve the ability of academic departments to allocate resources under local control for the benefit of student learning. The Dean determines the number of new positions that will be filled, allocating salary and benefits to academic departments for hiring tenure-eligible and tenured faculty into their programs. These allocations are based on the proposed alignment with the college's strategic and operational plans. Additionally, departmental administrators' operating budgets are adjusted according to long and short-term incentives based on their student enrollment and teaching efforts. For example, the college allocates flexible technology fees, summer teaching, and tuition revenues proportionally to the academic departments based on the enrollment of the students and the student credit hours of instruction.

The student computer/technology fees collected by the University are distributed to the colleges based on the number of majors and the number of student credit hours (SCHs) taught. The college's Engineering Fee Task Force then, after paying first for college-wide computer needs, distributes the remaining funds to the departments based on the same two factors.

Upper level (60+ credits) undergraduate and graduate engineering students are assessed a tuition rate (a.k.a., differential tuition) that is higher than most other majors at Iowa State University. This money, in addition to state appropriations and indirect cost recovery, funds the college of engineering's programs such as faculty salaries, office supplies, and utilities. The College budget model has financially incentivized student recruitment and retention by proportionally allocating $1.8M of the flexible differential tuition pool based on the enrollments of students who pay it.

Full time resident undergraduate engineering juniors and seniors paid an additional $1,043 for the fall 2011 semester. Engineering students entering the university directly from high school receive a four-semester exemption from differential tuition; the exemption for transfer students is two semesters.

Teaching Support

The Department provides graders for all lecture classes that have at least 25 students and for all laboratory classes with at least 15 students. The funds come from the general fund allocation to the department.

Teaching assistants (TA) are provided in support of the undergraduate teaching laboratories with funds from the differential tuition allocation to the department. With increasing enrollments, we are in the process of expanding the TA program, using a combination of differential tuition, general fund and technology funds. Each graduate student will receive departmental support to teach at least one semester. The TAs will teach as part of an assigned course, MSE 610, which will meet weekly to provide support and assessment of their teaching.

Acquiring, maintaining and upgrading the infrastructures, facilities and equipment

The laboratory facilities for undergraduate education in the MSE department are excellent. We have been able to provide our students with state-of-the art instruments. It is worth noting that state of the art instruments such as SEM, XRD, thermal characterization (TGA, DSC, TMA, DMA) and Spectroscopy (FTIR, Raman) are regularly used by our undergraduate students starting in the sophomore year. They are also used for research activities, for which a user fee is paid. These user fees are put into a fund that is used to support maintenance and repair. The instruments are under service contract or are maintained with the fund from the user fees or from an annual budget line for equipment repair and replacement. Responsibility for the teaching facilities is assigned to a senior lecturer. His responsibility includes checking readiness of the instruments for student use each semester. He is the custodian of the departmental equipment and responsible for acquisition of supplies and spare parts, making arrangements for service and repair of the equipment. He is supported by teaching assistants, as discussed above

Adequacy of the resources

We have sufficient resources to meet our objectives.

C. Staffing

The administrative staff of the Department has undergone significant changes since the last review, adding two new administrative staff, for a total of five positions. The administrative staff now consists of an Office Manager, a Fiscal Officer, a program assistant and one secretary. We are currently (May 2012) working to fill a position made empty by the death of one of our staff. The program assistant provides support to the undergraduate program, handling the administrative activities of the Undergraduate Curriculum Committee and the overall program, for example in compiling statistics and metrics needed for assessments. The program assistant also serves as the principal point of contact for the undergraduate students. A number of undergraduate students (currently three) work part-time to provide additional administrative help. The Department supports a ½ time IT support person to help maintain computers and their peripherals for the department, including the student computer rooms. One of the Senior Lecturers maintains the equipment for the undergraduate teaching labs, with the help of two teaching assistants. Finally, since the last ABET review, the Department added 1½ professional advisors to the program, who have started a successful peer mentor program and a mandatory learning community for our first-year students.

D. Faculty Hiring and Retention
Hiring New Faculty

When a tenure-track or tenured faculty member leaves a department for whatever reason, including resignation or retirement, the salary and benefits return to the College and are then pooled for all such positions across the college. The originating department retains $25K of salary savings for one year to support temporary lecturers or teaching assistants during the transition. The college determines the number of new positions that will be filled, after taking into account such factors as the budget climate, contingency for target-of-opportunity hires, and department chair searches.

Department chairs submit proposals to hire tenure-track or tenured faculty in their departments, for the current year and within the context of a broader multi-year plan. Those proposals estimate the rank of the hire, salary and benefits, start-up costs, and the department's commitment towards the start-up costs. The proposals are shared among the department chairs, the dean, the associate and assistant deans, and senior staff. The chairs present their proposals for discussion in a meeting. New perspectives and potential shared positions emerge because others participate and share their views.

The Dean allocates salary and benefits for hiring tenure-track or tenured faculty. An allocation may go to the department from which a faculty member left, or to another department. The decision-making process is consultative with the department. Opinions, feedback, and recommendations are encouraged and deliberately sought, and influence the decision, but in the end, the Dean decides the allocations. Once a hiring proposal is approved, the department may search for one year to fill the position. Thereafter, the department may request an extension.

Values that will be used in making these decisions to fill faculty positions include: Strategic research fit in energy systems, biosciences and engineering, information and decision sciences, sustainability, and critical infrastructure; Lowering the student-faculty ratio and promoting teaching excellence; Enhancing faculty diversity; Supporting research centers and institutes; Keeping strong programs strong; Advancing interdisciplinary teaching and research; and Establishing natural and meaningful collaboration between engineering departments, and with other colleges.

The College of Engineering diversity committee has developed a faculty search website as a resource for developing a diverse pool of candidates for the searches. It is a clickable flow chart that helps organize the search process and gives tips on each step. The site is: http://www.engineering.iastate.edu/faculty-search/.

As faculty searches progress, central start-up funds can be requested for the recruitment of tenured and tenure-eligible faculty. For example, departmental funding may be leveraged with College, Vice President for Research & Economic Development (VPRED), and other units. Typical, optimum support requested will be with a 30/30/40% ratio (Department/College/VPRED) to be paid out over 3 to 4 years. The College of Engineering views these start up packages as contractual commitments to the faculty member. Funds cannot be reallocated during the life of the commitment.

The College of Engineering takes the lead in strategizing start-up funding opportunities with the recruiting department(s) to optimize our processes in these circumstances. Requests are directed to the Associate Dean for Operations. The requesting department must make a compelling case for central funding, important as units consider how best to allocate resources. General practice is to identify the rank of the intended hire and the department's commitment towards the start-up costs, as well as alignment with the college's following values.

The availability of flexible support can make the difference when aiming to recruit new faculty to Iowa State. To establish and maintain effective research and teaching programs within the College, the aim is to provide as much flexibility as possible to hire the best candidates possible.

Retaining current qualified faculty

Retention starts at the hiring process. We strive to provide generous start-up packages to help the faculty member jumpstart their career. We provide an official mentor for all incoming professors and provide a number of other mentoring possibilities as well, including regular lunches with other assistant professors and the Department Chair. These lunches are held off site and offer a non-official opportunity to discuss various aspects of faculty success. Mentoring continues to be offered to all the tenured Associate Professors, as are the regular lunches with the Chair.

The most successful retention battle is one that never happens. The College and Department work to maintain an attractive environment for its faculty, including competitive pay and benefit packages as well as excellent support services. When offers are made to current faculty members, the University, College and Department work together to provide generous packages to help retain them.

E. Support of Faculty Professional Development

The University recognizes that significant opportunities for professional growth and development are required periodically by faculty members and that the Faculty Professional Development Assignment (FPDA) Program (a.k.a. sabbaticals) is one of the best modes in which to achieve such growth and development. The University strives to promote an environment in which the faculty will be motivated to participate enthusiastically in the Faculty Professional Development Assignment Program. This environment permits both the faculty and administration to plan so as to obtain the desired results from the program.

FPDA may be used to a number of purposes. Examples include: to conduct research or scholarship, to obtain new or specialized training; and to participate in an international program such as the Fulbright program.

PROGRAM CRITERIA

The program criteria for materials programs are

1. Curriculum
The curriculum must prepare graduates to apply advanced science (such as chemistry and physics) and engineering principles to materials systems implied by the program modifier, e.g., ceramics, metals, polymers, composite materials; to integrate the understanding of the scientific and engineering principles underlying the four major elements of the field: structure, properties, processing, and performance related to material systems appropriate to the field; to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems, and; to utilize experimental, statistical, and computational methods consistent with the program educational objectives.

2. Faculty
The faculty expertise for the professional area must encompass the four major elements of the field.

Curriculum

We have converted the paragraph listed in "curriculum" to student outcomes l, m, n, o in our list of outcomes as stated in Criterion 3 and repeated here. These four program criteria-based outcomes are then aligned with our objectives in Table B3.1 and their assessment is included with all other outcomes as shown in Table A4.1, for program educational objectives, and in Table B4.1, for student outcomes. The continuous improvement section in Criterion 4 describes in much greater detail how these outcomes are assessed. By the way, outcomes p, q, and r, although not program criteria outcomes, are outcomes specified by us and we feel they distinguish our program from others in materials. They too are assessed along with all other outcomes.

The Materials Engineering degree student outcomes are;

Graduates in Materials Engineering will have demonstrated the following at the time of graduation:

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively

h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of the need for and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
l. an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
m. an integrated understanding of the scientific and engineering principles underlying the four major elements of the field (structure, properties, processing, & performance)
n. an ability to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems
o. an ability to utilize experimental, statistical, and computational methods consistent with the goals of the program.
p. mastery of creative, independent problem solving skills, under time and resource constraints, in a broad range of materials-related applications critical to the success of the final product.
q. experience in materials engineering practice through co-ops or internships in industry, national laboratories, or other funded research work.
r. hands-on skills with a broad range of modern materials processing and characterization equipment and methods, with special in-depth concentration in two student-selected areas from among ceramic, electronic, metallic, and polymeric materials

Faculty

Faculty expertise is demonstrated throughout the section on Criterion 6 and, in particular for the four areas of materials, in Table 6-4.

APPENDICES

Appendix A – Course Syllabi

The following pages contain syllabi for all the required materials engineering courses as well as for the required English, science and mathematics courses. The supporting courses are listed first, then the core materials courses that all Mat E majors take, and finally the four specialty courses in each specialty.

Course Number and Name	ENGL 150. Critical Thinking and Communication.
Credits and Contact Hours	(3-0) Cr. 3. F.S.SS.
Instructor/Course Coordinator	ISUComm – Barb Blakely, Foundation Courses Director
Textbook and supplemental materials	Lunsford, Andrea. *The Everyday Writer, 8th edition*. Boston: Bedford/St. Martin's, 2010. Trimbur, John. *The Call to Write, Brief Fifth edition*. Boston: Wadsworth Cengage Learning, 2011. *ISUComm Foundation Courses Student Guide for English 150 and 250,* Iowa State University, Department of English, 2010 - 2011.
Catalog Description	Application of critical reading and thinking abilities to topics of civic and cultural importance. Introduction of basic oral, visual, and electronic communication principles to support writing development. Initiation of communication portfolio.
Pre-requisites	*Credit for or concurrent enrollment in LIB 160*
Required/Elective/Selected	required
Specific Outcomes	*Written* • adapt your writing to specific purposes, audiences, and situational contexts • integrate and document a range of informational sources, from personal interviews to print and electronic publications • practice varied organizational strategies and transitional devices • match expression to situation and audience, avoiding errors that distract or confuse • design effective presentation forms by attending to spacing, margins, headings, color, and typography • develop strategies to revise your own writing • reflect upon your communication processes, strengths, goals, and growth *Oral* • interview others, asking effective questions and listening actively • function as an effective team member in small groups as contributor, listener, collaborator, and presenter • develop basic oral presentation skills, focusing on meaningful information, clear organization, and engaging delivery *Visual* • use typography effectively, particularly in creating headings and subheadings • create an appropriate layout format for a bookmark, brochure, fact sheet, or newsletter • analyze visual communication, such as art on campus • use visuals effectively (e.g., imported, scanned, or digital pictures) and integrate them with written texts • accurately document visual sources *Electronic* • use appropriate format, voice, and language in a professional email (e.g., correspondence with an instructor) • use word processing skills, including making headings, attachments, tables, etc. • create an electronic composition (e.g., communication eportfolio) • choose one or more suitable media for delivering a communication to its intended audience
Topics	See Chart Below

Week	Topic(s)
Week 1	Introduction to course; Course policies awareness form; Semester portfolio intro; Introductory writing; Begin Asgnmt #2, Sharing Experiences: Letter-as-Essay or Memoir
Week 2	Continue work on Asgnmt #2, Sharing Experiences
Week 3	Finishing, reviewing, editing, and submitting Assignment #2, Sharing Experiences; Begin Assignment #3 (Exploring a Campus Place or Organization: Public Document and Profile)
Week 4	Continue Asgnmt #3 (Exploring a Campus Place or Organization: Public Document and Profile); Conferences; Presentations
Week 5	Individual Conferences; Continue working individually on Assignment #3 (Exploring a Campus Place or Organization)
Week 6	Peer Response for Asgnmnt #3; Continue Assignment #3 (Exploring a Campus Place or Organization); Assignment #3 DUE
Week 7	Begin Assignment #4: Analyzing Campus Place or Artifact. Report and Commentary
Week 8	Continue Assignment #4: Analyzing Campus Place or Artifact.
Week 9	Continue Assignment #4: Analyzing Campus Place or Artifact.
Week 10	Sharing Assignment #4: Analyzing Campus Place or Artifact. Paper due
Week 11	Begin Assignment #5: Designing Visual Communication: Web Page, Brochure, Poster
Week 12	Continue Assignment #5: Designing Visual Communication and work on oral presentation to accompany your visual
Week 13	Oral Presentations about Design Decisions in Visual Communication
Week 14	Begin #6: Portfolio
Week 15	Portfolios
Week 16	Final exam week.

Course Number and Name	**ENGL 250. Written, Oral, Visual, and Electronic Composition.**
Credits and Contact Hours	(3-0) Cr. 3. F.S.SS.
Instructor/Course Coordinator	ISUComm – Barb Blakely, Foundation Courses Director
Textbook and supplemental materials	Crusius, Timothy and Carolyn Channell. *The Aims of Argument: Text and Readings, 7th edition*. Boston: McGraw-Hill, 2011. *ISUComm Foundation Courses Student Guide for English 150 and 250,* Iowa State University, Department of English, 2010 - 2011. Lunsford, Andrea. *The Everyday Writer, 8th edition*. Boston: Bedford/St. Martin's, 2010.
Catalog Description	Analyzing, composing, and reflecting on written, oral, visual, and electronic (WOVE) discourse within academic, civic, and cultural contexts. Emphasis on supporting a claim and using primary and secondary sources. Continued development of student portfolio.
Pre-requisites	*ENGL 150 or exemption from ENGL 150; sophomore classification or exemption from ENGL 150; credit for or concurrent enrollment in LIB 160*
Required/Elective/Selected	required
Specific Outcomes	*Written* • analyze professional writing to assess its purpose, audience, and rhetorical strategies • construct arguments that integrate logical, ethical, and emotional appeals • write source papers analyzing a rhetorical situation and identifying and accurately documenting appropriate source material • avoid distracting or confusing sentence-level errors • reflect systematically upon all of your communication processes, strengths, goals, and growth *Oral* • give an oral presentation, either individually or as part of a team, using effective invention, organization, language, and delivery strategies • be an effective team member in small groups as a contributor, listener, and presenter *Visual* • rhetorically analyze visual communication, such as an advertisement, film, etc. • create a visual argument (i.e., advertisement, bookmark, poster, slide presentation) *Electronic* • rhetorically analyze electronic communication, such as emails or websites • create an electronic composition (e.g., communication eportfolio)
Topics	See chart below.

Week	Topic
1	Discussion of class policies. Sign Course Policy Awareness sheet. In-Class Literacy Autobiography
2	Summarizing an essay
3	Textual Rhetorical Analysis
4	Textual Rhetorical Analysis
5	Textual Rhetorical Analysis
6	Visual Rhetorical Analysis with Oral Presentation
7	Visual Rhetorical Analysis

8	Oral Presentation of Visual Rhetorical Analysis, Documented Essay
9	The Documented Essay of Mediation: Resolving Conflict
10	Documented Essay
11	Documented Essay
12	Individual Oral Presentations with Visual
13	Individual Oral Presentations with Visual. Individual Reflections
14	Portfolio
15	Portfolio
16	Finals Week

Course Number and Name	**LIB 160. Information Literacy.**
Credits and Contact Hours	(1-0) Cr. 1. F.S.SS.
Instructor/Course Coordinator	Dr. Susan Vega-Garcia
Textbook and supplemental materials	none
Catalog Description	Eight-week course required for undergraduate degree. Provides a solid understanding of information literacy and the research process with emphases on finding, evaluating, and using scholarly information; the ethical and legal framework related to information use; and utilization of library discovery tools. To be taken as early as possible in the student's undergraduate career. See course descriptions of ENGL 150 and ENGL 250 for requirements related to LIB 160. Offered on a satisfactory-fail basis only
Pre-requisites	*For students whose native language is not English: Completion of ENGL 101 requirement.*
Required/Elective/Selected	required
Specific Outcomes	The purpose of Library 160 is to introduce students to the use of academic research libraries, available library services, and electronic information resources, with an emphasis on information literacy and the research process. This course promotes student self-directed learning at ISU, and provides a foundation for life-long learning.
Topics	

Course Number and Name	**MATH 165. Calculus I.**
Credits and Contact Hours	(4-0) Cr. 4. F.S.SS.
Instructor/Course Coordinator	Coordinator: Jennifer Davidson, Associate Chair
Textbook and supplemental materials	Varberg, Purcell, Rigdon , *Calculus*, 9th edition
Catalog Description	Differential calculus, applications of the derivative, introduction to integral calculus. Only one of Math 151 or 160 or the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.
Pre-requisites	*Satisfactory performance on placement exam, 2 years of high school algebra, 1 year of geometry, 1 semester of trigonometry or enrollment in MATH 141 or MATH 142*
Required/Elective/Selected	required

Specific Outcomes	**Limits**
	• Use graphical and numerical evidence to estimate limits and identify situations where limits fail to exist.
	• Apply rules to calculate limits.
	• Use the limit concept to determine where a function is continuous.
	Derivatives
	• Use the limit definition to calculate a derivative, or to determine when a derivative fails to exist.
	• Calculate derivatives (of first and higher orders) with pencil and paper, without calculator or computer algebra software, using:
	    o Linearity of the derivative;
	    o Rules for products and quotients and the Chain Rule;
	    o Rules for constants, powers, trigonometric and inverse trignometric functions, and for logarithms and exponentials.
	• Use the derivative to find tangent lines to curves.
	• Calculate derivatives of functions defined implicitly.
	• Interpret the derivative as a rate of change.
	• Solve problems involving rates of change of variables subject to a functional relationship.
	Applications of the Derivative
	• Find critical points, and use them to locate maxima and minima.
	• Use critical points and signs of first and second derivatives to sketch graphs of functions:
	    o Use the first derivative to find intervals where a function is increasing or decreasing.
	    o Use the second derivative to determine concavity and find inflection points.
	    o Apply the first and second derivative tests to classify critical points.
	• Use Differential Calculus to solve optimization problems.
	The Integral
	• Find antiderivatives of functions; apply antiderivatives to solve separable first-order differential equations.
	• Use the definition to calculate a definite integral as a limit of approximating sums.
	• Apply the Fundamental Theorem of Calculus to evaluate definite integrals and to differentiate functions defined as integrals.
	• Calculate elementary integrals with pencil and paper, without calculator or computer algebra software, using:

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Linearity of the integral;
Rules for powers (including exponent -1) and exponentials, the six trigonometric functions and the inverse sine, tangent and secant;
Simple substitution.

Transcendental Functions

Use the relation between the derivative of a one to one function and the derivative of its inverse.
Calculate with exponentials and logarithms to any base.
Calculate derivatives of logarithmic, exponential and inverse trigonometric functions. Use logarithmic differentiation.
Use models describing exponential growth and decay.

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<tr>
<td>Topics</td>
<td>
<table>
<tr><td>Topic</td><td>Chapter & Sections</td><td></td><td>Time</td></tr>
<tr><td>Limits</td><td>Chapter
§1.1,
§§1.3-6,
Optional: §1.2</td><td>

Rigorous limits</td><td>1 7 days</td></tr>
<tr><td>The Derivative</td><td>Chapter 2
§§2.1-8,
Optional: §2.9</td><td>

Differentials and approximations</td><td>12 days</td></tr>
<tr><td>Applications of the Derivative</td><td>Chapter 3
§§3.1-5
§§3.8-9
Optional: §3.6 Mean Value Theorem
Optional: §3.7 Solving equations</td><td></td><td>11 days</td></tr>
<tr><td>The Definite Integral</td><td>Chapter 4
§§4.1-5,
Optional: §4.6 Numerical Quadrature</td><td></td><td>11 days</td></tr>
<tr><td>Transcendental Functions</td><td>Chapter 6
§§6.1-5,
§6.8,
Optional: §6.6 First-order linear differential equations,
Optional: §6.7 Approximations for differential equations,
Optional: §6.9 Hyperbolic functions</td><td></td><td>10 days</td></tr>
</table>
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</tr>
</table>

Course Number and Name	**MATH 166. Calculus II.**
Credits and Contact Hours	(4-0) Cr. 4. F.S.SS.
Instructor/Course Coordinator	Coordinator: Jennifer Davidson, Associate Chair
Textbook and supplemental materials	Varberg, Purcell, Rigdon , *Calculus*, 9th edition
Catalog Description	Integral calculus, applications of the integral, infinite series. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.
Pre-requisites	*Grade of C- or better in MATH 165 or high math placement scores*
Required/Elective/Selected	required
Specific Outcomes	**Applications of the Integral** Set up and evaluate integrals to calculate • Area of a plane region • Volume of a solid of revolution • Length of a plane curve • Area of a surface of revolution • Work done by a variable force • Force due to fluid pressure • Moments and center of mass of a plane lamina, centroid of a plane region. **Techniques of Integration** • Evaluate integrals of trigonometric functions. • Use trigonometric and rationalizing substitutions to evaluate integrals. • Carry out integration by parts and apply it to evaluate integrals. • Use partial fractions to evaluate integrals of rational functions. **Indeterminate Forms and Improper Integrals** • Apply l'Hospital's Rule to evaluate limits having the indeterminate forms $0/0$, ∞/∞, $0\cdot\infty$, $\infty-\infty$, 0^0, ∞^0 and 1^∞. • Determine convergence or divergence of improper integrals; evaluate improper integrals that converge. **Infinite Series** • Apply limit rules to calculate limits of sequences. Apply the concept of boundedness to identify convergent monotonic sequences. • Use the concept of partial sum to distinguish between convergent and divergent series and to define the sum of a convergent series. • Recognize geometric series and collapsing series and calculate their sums when convergent. • Use the integral test, the comparison test, the limit comparison test and the ratio test to determine the convergence or divergence of series. Use the error estimate derived from the integral test to estimate sums or tails of series. • Recognize alternating series, and apply the alternating series test and associated error estimate. Identify absolutely convergent series. • Determine radius of convergence and convergence set of a power series. • Perform algebraic operations on power series. Apply term-by-term integration and differentiation to power series. • Expand a function in a Taylor series. Recall and use the Taylor series of elementary functions. • Use the remainder in Taylor's formula to estimate the

<table>
<tr><td></td><td>approximation error in a Taylor polynomial.
Plane Parametric Curves, Polar Coordinates
• Derive parametric representations for plane curves described ``mechanically."
• Find tangents and compute length for parametric curves.
• Use polar coordinates, and convert between polar and rectangular coordinates.
• Identify the polar equations for lines, circles and conics.
• Compute the area of regions whose boundaries are defined by equations in polar coordinates.</td></tr>
<tr><td>Topics</td><td><u>Topic   Chapter & Sections</u>
<u>   Time</u>
Applications of the Integral,   §§5.1-6
Opt: Probability and Random Variables,   §5.7   12
days Techniques of Integration   §§7.1-6
            11 days Indeterminate Forms,
Improper Integrals   §§8.1-4   7
days Infinite Series   §§9.1-9
            16 days Parametric Curves,
Polar Coordinates   §§10.4-7   5
days</td></tr>
<tr><td></td><td></td></tr>
</table>

Course Number and Name	**MATH 265. Calculus III.**
Credits and Contact Hours	(4-0) Cr. 4. F.S.SS.
Instructor/Course Coordinator	Steve Butler
Textbook and supplemental materials	*Calculus, 9th Edition*, by Dale Varberg, Edwin Purcell and Steve Rigdon (ISBN: 0131429248 or 9780131429246).
Catalog Description	Analytic geometry and vectors, differential calculus of functions of several variables, multiple integrals, vector calculus.
Pre-requisites	*Grade of C- or better in MATH 166 or MATH 166H*
Required/Elective/Selected	Required
Specific Outcomes	**Geometry in Space, Vectors** • Use the parallelogram law to add geometric vectors. Resolve geometric vectors into components parallel to coordinate axes. • Perform the operations of vector addition and scalar multiplication, and interpret them geometrically. • Use the dot product to calculate magnitude of a vector, angle between vectors, and projection of one vector on another. • Find and use direction angles and direction cosines of a vector. • Use parametric equations for plane curves and space curves. • Use and convert between parametric and symmetric equations for a straight line. • Find a tangent line at a point on a parametric curve; compute the length of a parametric curve; compute the area of the surface generated by revolving a plane curve about an axis. • Compute velocity, unit tangent and acceleration vectors along a parametric curve; resolve acceleration into tangential and normal components and compute curvature. • Use and interpret geometrically the standard equation for a plane. • Use the cross product; interpret the cross product geometrically and as the area of a parallelogram; interpret the vector triple product as the volume of a parallelopiped. • Recognize cylinders and quadric surfaces from their Cartesian equations. • Use cylindrical and spherical coordinates, and convert among these two and rectangular coordinates. **Derivatives for Functions of Two or More Variables** • Represent a function of two variables as the graph of a surface; sketch level curves. • Calculate partial derivatives and the gradient. • Use the gradient to find tangent planes, directional derivatives and linear approximations. Interpret the gradient geometrically. • Use the Chain Rule. • Find and classify critical points of functions, using the second derivative test.

	• Use Lagrange's method to maximize or minimize a function subject to constraints. **Multiple Integrals** • State the definition of the integral of a function over a rectangle. • Use iterated integrals to evaluate integrals over planar regions, and to calculate volume. • Set up and evaluate double integrals in polar coordinates. • Set up and evaluate integrals to compute surface area. • Set up and evaluate triple integrals in Cartesian coordinates. • Use double and triple integrals to compute moments, center of mass, and moments of inertia. • Use cylindrical and spherical coordinates; change coordinates from rectangular to cylindrical or spherical or the reverse. • Set up and evaluate triple integrals in cylindrical and spherical coordinates. • Change the order of variables in multiple integrals. • Carry out change of variables in multiple integrals. **Vector Calculus** • Calculate the curl and divergence of a vector field. • Set up and evaluate line integrals of scalar functions or vector fields along curves. • Recognize conservative vector fields, and apply the fundamental theorem for line integrals of conservative vector fields. • State and apply Green's Theorem. • Set up and evaluate integrals to compute the area of parametric surfaces. • Set up and evaluate surface integrals; compute surface area and the flux of a vector field through a surface. • State and apply the Divergence Theorem. • State and apply Stokes' Theorem.
Topics	**Coordinate systems, Vectors, Dot and Cross products, Lines and planes, Vector valued functions, Curvature, Functions of several variables, Partial derivatives, Differentiability and tangent plane, Gradient, Chain rule, Maxima and minima, Lagrange multipliers, Multivariable integration, Integration with Cartesian coordinates, Integration in Polar coordinates, Applications of multiple integrals, Jacobian — Change of variables, Divergence and curl, Line integrals, Green's Theorem, Surface integrals, Divergence Theorem, Stokes's Theorem**

Course Number and Name	**MATH 267. Elementary Differential Equations and Laplace Transforms.**
Credits and Contact Hours	(4-0) Cr. 4. F.S.SS.
Instructor/Course Coordinator	Michael W. Smiley
Textbook and supplemental materials	***Elementary Differential Equations (9th Ed.)* , by William Boyce and Richard DiPrima** .
Catalog Description	Same as MATH 266 but also including Laplace transforms and series solutions to ordinary differential equations.
Pre-requisites	*Grade of C- or better in MATH 166 or MATH 166H*
Required/Elective/Selected	Required
Specific Outcomes	•
Topics	See Charts Below

Elementary Differential Equations and Boundary Value Problems, 9th Edition

From Table of Contents, topics covered

Chapter 1 Introduction 1
1.1 Some Basic Mathematical Models; Direction Fields
1.2 Solutions of Some Differential Equations
1.3 Classification of Differential Equations
Chapter 2 First Order Differential Equations
2.1 Linear Equations; Method of Integrating Factors
2.2 Separable Equations
2.3 Modeling with First Order Equations
2.4 Differences Between Linear and Nonlinear Equations
2.5 Autonomous Equations and Population Dynamics
2.6 Exact Equations and Integrating Factors
Chapter 3 Second Order Linear Equations 135
3.1 Homogeneous Equations with Constant Coefficients
3.2 Fundamental Solutions of Linear Homogeneous Equations; The Wronskian
3.3 Complex Roots of the Characteristic Equation
3.4 Repeated Roots; Reduction of Order
3.5 Nonhomogeneous Equations; Method of Undetermined Coefficients
3.7 Mechanical and Electrical Vibrations
3.8 Forced Vibrations
Chapter 4 Higher Order Linear Equations
4.1 General Theory of nth Order Linear Equations
4.2 Homogeneous Equations with Constant Coefficients
4.3 The Method of Undetermined Coefficients
Chapter 5 Series Solutions of Second Order Linear Equations
5.1 Review of Power Series
5.2 Series Solutions Near an Ordinary Point, Part I
5.3 Series Solutions Near an Ordinary Point, Part II
5.4 Euler Equations; Regular Singular Points
Chapter 6 The Laplace Transform
6.1 Definition of the Laplace Transform
6.2 Solution of Initial Value Problems
6.3 Step Functions
6.4 Differential Equations with Discontinuous Forcing Functions
6.5 Impulse Functions
6.6 The Convolution Integral

Course Number and Name	**CHEM 177. General Chemistry I**
Credit/offering	(4-0) Cr. 4. F.S.SS.
Instructor/Course Coordinator	Dr. Irmi Schewe-Miller
Textbook and supplemental materials	"*Chemistry: The Central Science*," 11th Ed., Brown, LeMay, Bursten, and Murphy, Prentice Hall, 2006. *Mastering Chemistry Student Access Kit* (web-based homework system), Prentice Hall; *Turning Point RF Clicker (RFC-03).* A *Study Guide*, a *Student Solutions Manual*, and *The Cartoon Guide to Chemistry* are available at the bookstores. These are not required, but students may find them useful.
Catalog Description	The first semester of a two semester sequence which explores chemistry at a greater depth and with more emphasis on concepts, problems, and calculations than 163-164. Recommended for physical and biological science majors, chemical engineering majors, and all others intending to take 300-level chemistry courses. Principles and quantitative relationships, stoichiometry, chemical equilibrium, acid-base chemistry, thermochemistry, rates and mechanism of reactions, changes of state, solution behavior, atomic structure, periodic relationships, chemical bonding. Credit by examination (test-out exams) for 177 is available only to students who are not currently enrolled in the course.
Pre-requisites	*MATH 140 or high school equivalent, and CHEM 50 or 1 year high school chemistry, and credit or enrollment in CHEM 177L. Chemistry and biochemistry majors may consider taking CHEM 201*
Required/Elective/Selected	Required
Specific Outcomes	
Topics	Week / Date / ***Chapter*** week 1 Jan 10,12,14 Introduction,***Chapter 1****:* Matter and Measurement week 2 Jan 19 Chapter 1: continued; Jan 21 ***Chapter 2:*** Atoms, Molecules, and Ions week 3 Jan. 24 **Last day to audit a class** Jan. 24,26 Chapter 2: continued; Jan. 28 ***Chapter 3:*** Stoichiometry week 4 Jan. 31,Feb.2 Chapter 3: continued Feb. 4 **Exam I** *(Chapters 1, 2 and part of 3)* week 5 Feb. 7 Chapter 3: continued Feb. 9,11 ***Chapter 4:*** Solution Stoichiometry week 6 Feb. 14,16 Chapter 4: continued Feb. 18 ***Chapter 5:*** Thermochemistry week 7 Feb. 21,23 25 Chapter 5: continued week 8 Feb. 28 Chapter 5: continued Mar. 2 ***Chapter 6:*** Electronic Structure Mar. 4 **Exam II** *(Chapters 3, 4 and 5)* week 9 Mar. 7,9 Chapter 6: continued Mar. 11 ***Chapter 7:*** Periodic Properties of the Elements Mar. 14-18 Spring Break (work on chemistry 24/7 ☺) week 10 Mar. 21,23,25 Chapter 7: continued Mar. 25 **Last day to drop without extenuating circumstances** week 11 Mar. 28,30,Apr.1 ***Chapter 8:*** Chemical Bonding week 12 Apr. 4,6 ***Chapter 9:*** Molecular Geometry Apr. 8 **Exam III** *(Chapters 6, 7 and 8)* week 13 Apr. 11 Chapter 9: continued Apr. 13,15 ***Chapter 10:*** Gases week 14 Apr. 18,20,22 ***Chapter 11:*** Intermolecular Forces

	Apr. 22	**Last day to request an alternative time for the final exam***
	week 15 Apr. 25,27	***Chapter 13:*** Solutions
	Apr. 29	Odds and ends
	TBA	**Optional exam**
	week 16 May 6	**9:45 –11:45 AM**
		Cumulative machine-scored Final Exam* (200 points)

Course Number and Name	CHEM 177L. Laboratory in General Chemistry I
Credits and Contact Hours	(0-3) Cr. 1. F.S.
Instructor/Course Coordinator	Dr. Irmi Schewe-Miller
Textbook and supplemental materials	"Chemistry: The Central Science," 11th Ed., Brown, LeMay, Bursten, and Murphy, Prentice Hall, 2006. Mastering Chemistry Student Access Kit (web-based homework system), Prentice Hall; Turning Point RF Clicker (RFC-03). A Study Guide, a Student Solutions Manual, and The Cartoon Guide to Chemistry are available at the bookstores. These are not required, but students may find them useful.
Catalog Description	Laboratory to accompany 177. 177L must be taken with 177. 177N: For chemistry and biochemistry majors. Only one of Chem 163L, 167L, and 177L may count toward graduation
Pre-requisites	Credit or enrollment for credit in CHEM 177
Required/Elective/Selected	Required
Specific Outcomes	
Topics	See chart below.

Week	Topic
1	Exp. 1 Measurements; Safety Rules
2	Lab Check-In; Finish Measurements; Safety: Personal Protection and Laboratory Protocol;
3	Exp. 2 Observing Chemical Reactions
4	Exp. 3 The Empirical Formula of an Oxide of Copper. Safety Reading 1: Toxicology – Routes of Entry, Dose
5	Exp. 4 The Conversion of Aluminum to Aluminum Potassium Sulfate – report due the week 12. (; Safety Reading 2: Toxicology – Exposure Limits; Start Safety Reading 3 [due following week]
6	Exp. 5 Acids, Bases and their Reactions: Some Quantitative Experiments. Safety Reading 3: Toxicology – Hazard Warnings, NFPA Signs and Other Symbols, Chemical Labels
7	Exp. 6 The Heat of Formation of Magnesium Oxide. Safety Reading 4: Material Safety Data Sheets
8	Lab Practical Exam I
9	Exp. 7 Atomic Spectroscopy [including flame tests but not flame temperature]; Safety Reading 5: Material Safety Data Sheets
10	Exp. 8 The Preparation of Aspirin; Safety Reading 6: Material Safety Data Sheets
11	Exp. 9 Gas Phase Chemical Reactions; Safety Reading 7: Material Safety Data Sheets
12	Exp. 10 Optical Diffraction Experiments; "The Conversion of Aluminum to Aluminum Potassium Sulfate" lab report due. Safety Reading 8: Federal Organizations: OSHA, EPA
13	Lab Practical Exam II
14	Exp. 11 Chromatography of Amino Acids
15	Lab check-out; Attendance is required.

Course Number and Name	CHEM 178. General Chemistry II
Credit/offering	(4-0) Cr. 4. F.S.SS.
Instructor/Course Coordinator	Dr. Cristina Bonaccorsi
Textbook and supplemental materials	“Chemistry: The Central Science,” 11th Ed., Brown, LeMay, Bursten, and Murphy, Prentice Hall, 2006. Mastering Chemistry Student Access Kit (web-based homework system), Prentice Hall; Optional: Student Guide and Student Solutions Manual for the textbook; “Preparing for Your ACS Examination in General Chemistry, The Official Guide”, L. Eubanks, and I. D. Eubanks, Examinations Institute, American Chemical Society, Division of Chemical Education, ISBN 0-9708042-0-2
Catalog Description	Continuation of 177. Recommended for physical or biological science majors, chemical engineering majors, and all others intending to take 300-level chemistry courses. Credit by examination (test-out exams) for 178 is available only to students who are not currently enrolled in the course.
Pre-requisites	CHEM 177, CHEM 177L
Required/Elective/Selected	Required
Specific Outcomes	
Topics	See chart below

Week	Topic
1	Properties of Solution
2	Chemical Kinetics
3	Chemical Kinetics, continued
4	Chemical Kinetics, continued; Chemical Equilibrium
5	Chemical Equilibrium continued
6	Chemical Equilibrium continued
7	Acid-Base Equilibria
8	Acid-Base Equilibria continued; Aqueous Equilibria
9	Aqueous Equilibria continued
10	Aqueous Equilibria continued
11	Electrochemistry
12	Electrochemistry continued; Chemical Thermodynamics
13	Chemical Thermodynamics continued
14	Chemical Thermodynamics continued
15	Chemistry of Life: Organic and Biological Chemistry; Nuclear Chemistry

Course Number and Name	CHEM 178L. Laboratory in General Chemistry II
Credits and Contact Hours	(0-3) Cr. 1. F.S.SS.
Instructor/Course Coordinator	Thomas J. Greenbowe
Textbook and supplemental materials	Chem 178L Laboratory Manual 2011, Hayden-McNeil. ISBN 978-0-7380-4940-
Catalog Description	Laboratory to accompany 178. 178L is not a necessary co-requisite with 178
Pre-requisites	Credit or enrollment for credit in CHEM 167
Required/Elective/Selected	Required
Specific Outcomes	
Topics	See chart below.

Week	Topic
1	Check-in and safety procedures. Experiment #1 Freezing Point Matters Part A
2	Experiment #1 Freezing Point Matters Part A
3	Experiment #3 Kinetics of a Clock Reaction Part A
4	Experiment #3 Kinetics of a Clock Reaction Part B; Safety Quiz #1 due
5	Experiment #4 Reversible and Irreversible Processes
6	Experiment #5 More Reversible and Irreversible Processes; Safety Quiz #2 due
7	Experiment #6 Analysis of Common Household Products; Safety Quiz #3 due
8	Experiment #7 What is in the Water? Acids and Bases; Safety Quiz #4 due
9	Experiment #8: Analysis of Buffer Systems, Salts and Hydrolysis, Parts 1-2
10	Experiment #8: Analysis of Buffer Systems, Salts and Hydrolysis, Parts 3-4; Safety Quiz #5 due; Mini Lab Practical Exam
11	Experiment #10 REDOX Titrations
12	Experiment #11 What Makes a Solution produce a Solid? Safety Quiz #6 Due
13	Experiment #12 Electricity from Chemical Reactions; Safety Quiz #7 due
14	Lab Practical Exam (Comprehensive tasks covering all the topics)
15	Lab check-out; Attendance is required.

Course Number and Name	PHYS 221. Introduction to Classical Physics I.
Credits and Contact Hours	(4.5-1) Cr. 5. F.S.SS.
Instructor/Course Coordinator	Instructors: Dr. Soeren Prell, Dr. Kai-Ming Ho, Dr. Anatoli Frishman Course Secretary: Deb Schmidt
Textbook and supplemental materials	*University Physics (12th Edition)*, Young and Freedman (Pearson, Addison Wesley 2008). If you are only taking Physics 221 and will not take Physics 222, you can get Volume 1 (Ch. 1-20) for Physics 221 only. **Required**: access code for Mastering Physics online homework system. Optional: *Student Solutions Manual* (available in the bookstore). This contains complete solutions to many end-of-chapter problems. Physics 221 Laboratory Manual (University Bookstore). We will be using the Turning Point RF Clickers in the lectures.
Catalog Description	For engineering and science majors. 3 hours of lecture each week plus 3 recitations and 1 laboratory every 2 weeks. Elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. Heat, thermodynamics, kinetic theory of gases; waves and sound.
Pre-requisites	*Credit or enrollment in MATH 166*
Required/Elective/Selected	required
Specific Outcomes	None listed.
Topics	signif. figures, order of magnitude, Vectors, products, components, 1-dimensional motion, Free fall, 2-Dim motion, projectiles, Circular motion, Relative motion, Forces, Newton's 1st and 2nd Laws, Newton's 3rd law, Free body diagrams, Friction, Circular motion dynamics, Work-kinetic-energy theorem, Varying forces, power, Energy conservation, Potential energy, Energy diagrams, Linear momentum and impulse, Elastic and inelastic collisions, Center of mass, Rigid body rotation, moment of inertia, Torque, Rotations, work, power, Angular momentum, Statics, Elasticity. Gravitation. Periodic motion, the spring, The pendulum and damped oscillations, Mechanical waves, transverse waves, Sound waves, Energy, intensity, Resonance, Interference, Standing waves, Beats, Doppler, Temperature, thermometers, thermal expansion, Heat and phase changes, Waves (Doppler and beats), Heat transfer, Equations of state, Ideal gas, Kinetic model, Phase diagrams, First law of thermodynamics, Thermal processes, Heat capacities, Heat engines and refrigerators, Second law of thermodynamics, Carnot cycle, Entropy

Course Number and Name	**PHYS 222. Introduction to Classical Physics II.**
Credits and Contact Hours	(4-2) Cr. 5. F.S.SS.
Instructor/Course Coordinator	**Dr. Paula Herrera-Siklódy /** Deb Schmidt
Textbook and supplemental materials	*University Physics* (12th or 11th Edition), Young and Freedman (Pearson, Addison Wesley) Physics 222 Laboratory Manual, Spring 2012 edition (University Bookstore)
Catalog Description	3 hours of lecture each week plus 1 recitation and 1 laboratory each week. Electric forces and fields. Electrical currents; DC circuits. Magnetic forces and fields: LR, LC, LCR circuits; Maxwell's equations; ray optics and image formation; wave optics; topics in modern physics.
Pre-requisites	*PHYS 221, MATH 166*
Required/Elective/Selected	Required
Specific Outcomes	•
Topics	Electric charge, Coulomb's Law, Electric Field, dipole, flux, Gauss's Law, Conductors, potential, capacitors, energy storage and dielectrics, Ohm's Law, EMF, batteries, instruments, circuits, Kirchhoff's rules, magnetic field, Lorentz force, flux, current loops, motors, Ampere's Law, induction, Faraday's Law, Lenz's Law, inductance, magnetic energy, LR and LC circuits, AC circuits, phasors, AC power, resonance, transformers, Maxwell's equations, electromagnetic waves, energy and momentum, polarization, propagation of light, reflection and refraction, plane surfaces and spherical mirrors, lenses, camera, eye, magnifier, interference, geometrical optics, thin films and interferometers, diffraction, Rayleigh's criterion, diffraction grating, X rays

Course Number and Name	Engr 160. Engineering Problems with Computer Applications Laboratory
Credits and Contact Hours	(2-2) Cr. 3. F.S.SS
Instructor/Course Coordinator	Martha Selby
Textbook and supplemental materials	a. Engr 160/160H custom published for Iowa State University, by Martha Selby. This is a custom published version from: Engineering Fundamentals and Problem Solving, by Arvid Eide, et. al. b. Courseworks Engr 160 packet (from bookstore)
Catalog Description	Solving engineering problems and presenting solutions through technical reports. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to mechanics, statistics and engineering economics. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. (The honors section includes application of programming to mobile robotics).
Pre-requisites	MATH 142 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Required/Elective/Selected	Required of all engineering students (Basic Program)

Specific Outcomes	• Develop a systematic approach to solving engineering problems.
	  o Demonstrate and practice problem solving skills by solving problems in various areas such as statics and engineering economy.
	• Use a computer programming language as a tool to solve engineering problems.
	  o Develop an algorithm and flowchart for a problem solution
	  o Following the flowchart, write a computer program that provides a friendly interface and useable output.
	• Produce professional, computer generated, project reports that conform to engineering presentation standards.
	  o Use appropriate computer software to include computer generated graphs and tables in project reports.
	• Develop professional work ethics, including precision, neatness, and ability to follow instructions and meet deadlines.

Topics	See below

Week	Dates	Topics	Reading	Homework
1 (MW)	1/9, 1/11	Engineering Problem Solving & Presentation	Chap 4, p.77	4.7, 4.19, 4.27 Due: **1/23**
2 (MW)	**1/16(no class)**, 1/18	Dim., units and sig. figs Excel intro	Chap 6, p.139 Chap 7, p.159	6.12, 7.14, 7.17 Due: **1/30**
3 (MW)	1/23, 1/25	Graphing, Excel Flowcharting	Chap 5,p.99 Chap 3(7), p.53	**Please refer to the WebCT calendar**
4 (MW)	1/30, 2/1	VBA: Getting started in programming	Courseworks: VBA 1	**for up-to-date homework**
5 (MW)	2/6, 2/8	VBA: Controlling program flow	Courseworks: VBA 2	**information for the rest of the semester**
6 (MW)	2/13, **2/15-No class**	Review/ **NIGHT EXAM 1 Tuesday, 2/14, 8 – 10pm**		
7 (MW)	2/20, 2/22	Statistics Mechanics (statics)	Chap 10, p.235 Chap 11, p.267	
8 (MW)	2/27, 3/1	Statics continued	Chap 11, p.267	
9 (MW)	3/5, 3/7 3/6, 3/9	VBA: functions and subroutines	Courseworks: VBA 3	
---------	**3/12 – 3/16**	**Spring Break**	-----------------	
10(MW)	3/19, 3/21	VBA: file input/output, one-dimensional arrays	Courseworks: VBA 4 & 5	
11(MW)	3/26, 3/29	Programming continued, 1D arrays with subs		
12(MW)	4/2, **4/4-No class**	Review/ **NIGHT EXAM 2 Tuesday, 4/3, 8 - 10pm**		
13(MW)	4/9, 4/11	VBA: two-dimensional arrays, Excel programming	Courseworks: VBA 5	
14(MW)	4/16, 4/18	Engineering Economics	Chap 8, p.185 Chap 9, p. 227	
15(MW)	4/23 4/25	Economics continued, programming review		
16	**Finals Week**	See final schedule for Engr 160 group final time.		

Course Number and Name	**E M 274. Statics of Engineering.**
Credits and Contact Hours	(3-0) Cr. 3. F.S.SS.
Instructor/Course Coordinator	Peggy Boylan-Ashraf
Textbook and supplemental materials	Statics, 6th Ed., Meriam and Kraige Other resources: WileyPlus, BbLearn
Catalog Description	Vector and scalar treatment of coplanar and noncoplanar force systems. Resultants, equilibrium, friction, centroids, second moments of areas, principal second moments of area, radius of gyration, internal forces, shear and bending moment diagrams.
Pre-requisites	*Credit or enrollment in MATH 166; credit or enrollment in PHYS 111 or PHYS 221*
Required/Elective/Selected	Required
Specific Outcomes	
Topics	See Below

Day		Date		Ch/Sect	Topics	HW Problems
1	M	Jan	9		Overview	---
2	W		11	1/1-9	Vectors	1/**2**, **4**
3	F		13	2/1-3	Force Systems	2/**4**,**7**,**8**
4	M		16		**NO CLASS -- UNIVERSITY HOLIDAY**	---
5	W		18	2/4	Moments (2-D)	2/**12**, 15 ,17
6	F		20	2/4	Moments (2-D)	2/41, **44**, **48**
7	M		23	2/5	Couples, Force/Couples	2/**60**, 66,71
8	W		25	2/6	Resultants (2-D)	2/**84**,85,87
9	F		27	2/6	Resultants (2-D)	2/89, **94**,96
10	M		30	2/7-8	Forces and Moments in 3-D	2/104,110,113,**132**
11	W	Feb	1	2/9	Resultants (3-D)	2/**152**,153,156
12	F		3	3/1-2	Equilibrium, Free Body Diagrams	---
13	M		6	3/3	Equilibrium (2-D)	3/**4**,9,11
14	W		8	--	Review	---
	TH		9		**THURSDAY NIGHT EXAM 1**	
15	F		10		**NO CLASS**	---
16	M		13	3/3	Equilibrium (2-D)	3/17,**20**,22
17	W		15	3/4	Equilibrium (3-D)	3/67,**70**,75
18	F		17	3/4	"	3/79,83,**94**
19	M		20	4/1-3	Plane Trusses, Method of Joints	4/**2**,7,17
20	W		22	4/4	Plane Trusses, Method of Sections	4/29,31,**40**
21	F		24	4/4	"	4/**42**,51
22	M		27	4/6	Frames and Machines	4/71,**78**,81
23	W		29	4/6	"	4/96,99,**114**
24	F	March	2	4/6	"	4/**108**,111, 125
25	M		5	4/6	"	4/**112**,127, 131
26	W		7	5/1-5	Centroids	5/10,**16**,19
27	F		9	5/1-5	"	5/35,**46**,48
28	M		12			
29	W		14		**SPRING BREAK –NO CLASS**	
30	F		16			
31	M		19	5/9	Fluid Statics	5/176,177,**186**
32	W		21	---	Review	---
	TH		22		**THURSDAY NIGHT EXAM 2**	
33	F		23		**NO CLASS**	
34	M		26	5/6-7	Beams	5/95,**96**
35	W		28	5/6-7	"	5/117,**122**,125
36	F		30	5/6-7	"	5/126,**136**,137

EM 274 Spring 2012

37	M	April	2	6/1-3	Friction	6/7,**8**,15,20,**24**
38	W		4	6/4-8	Friction Applications	6/**54**,55,78
39	F		6	6/4-8	"	6/**94**,95,**104**
40	M		9	A/1-4	Area Moments	A/5,8,23, **36**
41	W		11	A/1-4	"	A/43,46,**64**
42	F		13	A/1-4	"	A/72,**80**,85
43	M		16	Notes	Area Moments/ Matrices	---
44	W		18	---	Review	---
	TH		19		**THURSDAY NIGHT EXAM 3**	
45	F		20		**NO CLASS**	
46	M		23	---	Exam Review	---
47	W		24	---	Course Review	---
48	F		27	---	"	---

FINAL

Course Number and Name	**E M 324. Mechanics of Materials**
Credits and Contact Hours	(3-0) Cr. 3. F.S.SS.
Instructor/Course Coordinator	Dr. Loren Zachary
Textbook and supplemental materials	Mechanics of Materials: An Integrated Learning System by Timothy A. Philpot (2nd Edition) Other resources: WileyPlus
Catalog Description	Vector and scalar treatment of coplanar and noncoplanar force systems. Resultants, equilibrium, friction, centroids, second moments of areas, principal second moments of area, radius of gyration, internal forces, shear and bending moment diagrams.
Pre-requisites	EM 274
Required/Elective/Selected	Required
Specific Outcomes	
Topics	See Below

Period	Topic
1	Use of FBDs and Problem Solving Expectations
2	Normal Stress
3	Shear & Bearing Stresses
4	Stresses on an Inclined Plane
5	Normal Strain
6	Shear Strain & Temperature Induced Strains
7	Mechanical Properties
8	Allowable Stress Design
9	Axial Deformation
10	Axial Deformation
11	Statically Indeterminate Axial Loaded Members
12	Temperature Effects
13	Torsional Stresses & Angles of Twist
14	Torsional Stresses & Angles of Twist
15	Gear Trains & Power
16	Indeterminate Torsion
17	V&M Equations & Diagrams (Graphical)
18	V&M Diagrams
19	Flexural Stresses
20	Flexural Stresses
21	Combined Axial and Flexural Stresses
22	Shear Stresses in Beams
23	Shear Stresses in Circular and I-Beam Shapes
24	Beam Deflections by Integration
25	Beam Deflections by Superposition
26	Beam Deflections by Superposition
27	Statically Indeterminate Beams
28	Stress Transformations
29	Principal Stresses
30	Mohr’s Circle
31	Strain Transformations, Principal Values, Gages
32	Generalized Hooke’s Law
33	Thin Walled Pressure Vessels
34	Combined Loads
35	Combined Loads
36	Theories of Failure
37	Columns
38	Stress Concentrations

Materials Core Courses: Two versions of ENGR 101 are taken, the first syllabus is for those students who are “undeclared” engineers their first semester and haven’t yet declared a Mat E major and the second one is for those who have declared a Mat E major.

Course Number and Name	**ENGR 101. Engineering Orientation. (for undeclared engineering majors)**
Credits and Contact Hours	Cr. R. F.S.
Instructor/Course Coordinator	**Amy Brandau**
Textbook and supplemental materials	n/a
Catalog Description	Introduction to the College of Engineering and the engineering profession. Information concerning university and college policies, procedures, and resources. Undeclared sections: Considerations in choosing an engineering curriculum. Opportunities to interact with departments. Declared sections: Introduction to major-specific topics. Offered on a satisfactory-fail basis only.
Pre-requisites	none
Required/Elective/Selected	required
Specific Outcomes	• Familiarize you with Iowa State University and the College of Engineering • Provide you with knowledge of resources to help you succeed at Iowa State • Help you become familiar with engineering and the disciplines offered at ISU
Topics	See Below

Week	Date	Schedule & Assignments	Assignments Due	Events/ Handouts
1	Aug. 24/26	Lecture: Introduction / Campus Resources / What is Engineering *Complete Department/Club Visit,* ***due Week 11***		Class Syllabus Help Resources Department/Club Visit Wkst
2	Aug. 31/ Sept. 2	Lecture: Engineering Competencies / Résumé Tips / Weekly Study Planning *Complete Weekly Study Plan,* ***due Week 3*** *Complete Résumé,* ***due Week 5***		List of Engineering Competencies Weekly Study Plan
3	Sept. 7/9	***Presentations – Dr. Jonathan Wickert, Dean and E-Week*** Lecture: Career Development – Career Fair / Co-ops and Internships / Interviewing Tips *Complete Career Fair Worksheet,* ***due Week 6*** *Academic Success Worksheet,* ***due Week 5***	*Weekly Study Plan due*	Academic Success Wkst Career Fair Wkst **Tour the World – Engineering Study & Work Abroad Fair – Sept. 7, 5:30-7:00 pm, Howe Hall Atrium** **ISU ClubFest – Sept. 8, 11am-4pm Great Hall, Memorial Union**

4	Sept. 14/16	***Presentations – Industrial Engineering, International Programs and Mechanical Engineering***		**E-Week 2010 - Sept. 13-21 Career Skills Presentations Sept. 19- 20**
5	Sept. 21/23	***Attend Engineering Career Fair Sept. 21 12:00-6:00pm Hilton Coliseum/Scheman Presentations – Chemical Engineering and Software Engineering Departments***	*Résumé due Academic Success Worksheet due*	
6	Sept. 28/30	***Presentation – Electrical Engineering and Computer Engineering Departments*** *Complete Explore Engineering Major Worksheet,* ***due Week 8***	*Career Fair Worksheet due*	Explore Engr. Major Worksheet
7	Oct. 5/7	Lecture: Curriculum Planning Registration & Scheduling / ISU policies & procedures *Complete Schedule Evaluation & Proposal Worksheet,* ***due Week 9***		SSH Electives SSH Requirements Schedule Evaluation & Proposal Wkst
8	Oct. 12/14	***Presentation - Construction Engineering Department*** Lecture: Midterms / Academic Recovery	*Explore Engineering Major Wkst due*	
9	Oct. 19/21	***Presentations – Materials Engineering Department***	*Schedule Eval & Proposal Wkst due*	**Midterm Grades Registration begins Oct. 21 for seniors**
10	Oct. 26/28	***Presentation – Agricultural Engineering & Biological Systems Engineering Departments***		**Last Day to drop a class - Oct. 29**
11	Nov. 2/4	***Presentations – Aerospace Engineering and Civil Engineering Departments*** Course Wrap-Up *Complete Course Evaluation on WebCt* **LAST DAY OF CLASS**	*Make sure you have made a student visit to an engineering department or club & turned in the worksheet.*	

Course Number and Name	**ENGR 101. Engineering Orientation.**
Credits and Contact Hours	Cr. R. F.
Instructor/Course Coordinator	**Andrea Klocke**
Textbook and supplemental materials	n/a
Catalog Description	Introduction to the College of Engineering and the engineering profession. Information concerning university and college policies, procedures, and resources. Undeclared sections: Considerations in choosing an engineering curriculum. Opportunities to interact with departments. Declared sections: Introduction to major-specific topics. Offered on a satisfactory-fail basis only.
Pre-requisites	none
Required/Elective/Selected	Required
Specific Outcomes	• Familiarize you with Iowa State University and the College of Engineering • Provide you with knowledge of resources to help you succeed at Iowa State • Help you become familiar with Materials Science & Engineering at ISU • Addresses the following outcomes from Criterion 3: F, G
Topics	See Below

Week	Schedule & Assignments	Assignments Due
1	Welcome to MSE! Meet your Mat E Peer Mentors & fellow students	
2	What is Materials Engineering?	
	Attend "Tour the World" – a study/work abroad fair coordinated by Engineering International Programs.	**Sign attendance sheet at the fair**.
3	MSE Study Abroad Opportunity – Brunel Program Speaker: Dr. Scott Chumbley, MSE Faculty Member & Brunel Program Coordinator	**Reflection essay:** What brought you to Mat E and what interests you about MSE as a future career?
4	Advising Expectations & Important ISU/CoE Policies MAP-Works Survey	

5	Introduction to Engineering Career Services: Preparing for Fall Career Fair, Intro to ISU-CMS Speaker: Staff from Engineering Career Services	**Complete MAP-Works Survey** (*optional*)
	Attend the ISU College of Engineering Career Fair	
6	Workplace competencies – OPAL survey Behavioral Based Interviews and STAR responses	**Turn in resume used at Career Fair**
7	Current Topics in Materials Science & Engineering Speaker: Dr. Richard LeSar, MSE Department Chair	**Complete OPAL survey** **Peer Mentor Evaluation**
8	Speaker from Academic Success Center Stress Management and Time Management	
9	Registration Advising Degree audits, RAN, advising appt, selecting Gen Ed courses, declaring minors/majors	**Self-Assessment Form**
10	MSE Faculty Panel Current research topics at ISU in MSE Q & A regarding curriculum in MSE	**Reflection essay:** What do you expect from me as an advisor? What should I know about you to help advise you? **Bring a question to ask an MSE faculty member**
11	Mat E Student Panel re: Internships, REU experiences and undergraduate research assistant positions within MSE	**Reflection essay:** What is something you learned from the faculty about MSE that interests you?
12	Presenter: Dr. Larry Genalo, Associate Chair of MSE *Materials Engineering Demos*	
13	Wrap-up & Course Evaluation	

1. Course number and name Mat E 201 Professional Planning

2. Credits and contact hours R – 15 total contact hours

3. Instructor's or course coordinator's name – Kristen P. Constant

4. Text book, title, author, and year

    a. No textbook – handouts and Blackboard Learn Posted lectures

5. Specific course information
    a. brief description of the content of the course (catalog description) Preparation for a career in materials engineering; experiential learning, resumes, interviewing, Myers-Briggs Type Indicator, leadership, undergraduate research, international opportunities, graduate school preparation and opportunities, and alternative career paths.
    b. prerequisites or co-requisites – sophomore classification in Materials Engineering
    c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program – REQUIRED for Mat E majors

6. Specific goals for the course
    a. specific outcomes of instruction, ex. The student will be able to:

    • plan their academic experiences according to their interests, career goals and self-assessment of competencies
    • make an informed decision about pursuing graduate studies in Mat E or complementary fields (Law, Medicine, Business)
    • prepare a professional resume and cover letter for employment
    • describe basic ethical considerations in the context of engineering practice according to the Engineering Code of Ethics
    • function as a member of a diverse work group with appreciation for individual differences

    b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

    This course has been designed to contribute to the following program outcomes:

d. an ability to function on multi-disciplinary teams
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
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

q. experience in materials engineering practice through co-ops or internships in industry, national laboratories, or other funded research work.

7. Brief list of topics to be covered
    - Resumes, cover letters
    - OPAL (On-line Performance Assessment of Learning)
    - Global Opportunities
    - Sustainability, the 2050 challenge
    - Non-traditional career paths, Law, MBA, Medicine, Peace Corps
    - Grad School
    - Undergraduate Research Opportunities
    - Discussions with recent materials engineering grads
    - Evaluating a job offer
    - Specializations, proposal-based specializations and minors in engineering (and others)
    - Introduction to Ethics, Engineering Code of Ethics
    - Ethics case studies
    - MBTI test and discussion of results
    - Implicit bias tests and discussion of results

1. Course number and name
   Mat E 214 Structural Characterization of Materials

2. Credits and contact hours
   3 credits. 2 hours of lecture and 3 hours of lab per week

3. Instructor's or course coordinator's name:
   M. (Hogan) E. Martin

4. Text book, title, author, and year: **None**
   a. other supplemental materials
   b. Elements of X-ray Diffraction, B.D. Cullity;
   c. Fundamentals of Powder Diffraction, V. K. Pecharsky and P.Y. Zavalij
   d. Scanning Electron Microscopy and X-ray Microanalysis, Goldstein et. al.;
   e. Handbook of Thermal Analysis, T. Hatakeyama & Z. Liu;
   f. Optical Microscopy for the Materials Sciences, J. H. Richardson;
   g. A guide to materials characterization and chemical analysis, Sibilia, John P.

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Structural characterization of ceramic, electronic, polymeric and metallic materials. Techniques include optical and electron microscopy, x-ray diffraction, and thermal analysis methods. Identification of materials type, microstructure, and crystal structure.
   b. prerequisites or co-requisites
      Phys 221
   c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program
      REQUIRED

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
      The student will be able to interpret the results from optical and electron microscopy, x-ray diffraction, and thermal analysis methods and will be able to select which of these methods are best suited to gain desired information about a material.
   b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      A,B,G,K,L,M,O,R

7. Brief list of topics to be covered

   Optical Microscopy

1 The Metallographic Microscope: Principles and Practice
Visible light optics; Introduction to microstructure
2 Specimen Preparation for Optical Microscopy
The metallographic microscope; Techniques of optical microscopy
3 Quantitative Analysis of Microstructures
Methods of Specimen Preparation; Quantitative Analysis of Microstructures

X-ray Diffraction (XRD)

Lecture 1 Operation of the X-ray Diffractometer
2 Theory of X-ray Diffraction
3 X-ray Diffraction Studies

Lab 1,2,3 X-ray Identification and Characterization of metals, ceramics, and polymers.

Scanning Electron Microscopy (SEM)

1 The Scanning Electron Microscope: Principles and Practice
Electron beam – material interactions; The SEM: components and operation
2 Specimen Preparation and Imaging Techniques
SEM Detectors and contrast mechanisms; Fundamentals of SEM imaging
3 Microchemical analysis and elemental mapping
Resolution and Magnification; Microchemical analysis: EDS,WDS

Thermal Analysis

Lecture 1 Operation of the Thermal Analysis Equipment and Software
2 Theory of Thermal Analysis
3 Applications of Thermal Analysis

Lab 1,2,3 Thermal analysis of metals, ceramics, and polymers (TMA, TGA andDSC resp.)

Mat E 215 - Fall 2011 Syllabus

1. Mat E 215. Introduction to Materials Science and Engineering I

2. Credits = 3; Fall Semester; Lecture-Recitation: MWF 10:00-10:50; 1304 Howe Hall
(Note: The 215L lab course is associated with this course is a separate class, taught by a different instructor.)

3. Instructor: Alan Russell, 2220K Hoover Hall (office phone: 294-3204)
office hours: Mon 4-5; Wed 3-4 (other times easily arranged)
russell@iastate.edu home phone: (515) 292-2526

4. Text: Callister & Rethwisch, Materials Science and Engineering: an Introduction, 8th ed., 2010

5. a. Course description: Structure and properties of materials, emphasizing metallic materials and the differences in materials properties based on their structure and bonding. Phase equilibria and phase transformations.
b. Prerequisite: Chemistry 177 or 167
c. Required course

6. a. Specific Goals for the Course: After successful completion of this course, the student will be able to:

- Build a model of a crystal structure given Bravais lattice, lattice parameters, and atomic position indices, and identify and sketch planes and directions in simple structures

- Interpret one- and two-component phase diagrams and sketch likely microstructures of resulting materials

- Measure and interpret the meaning of bulk properties of materials such as density, elastic modulus, yield and ultimate tensile strength, ductility, electrical resistivity, thermal conductivity

- Predict how the presence of defects in crystalline materials will change the engineering properties of those materials

- Select candidate materials for particular applications given basic knowledge of materials properties and expected service/environmental conditions

b. Student outcomes addressed by the course: A, B, D, E, G, K, L, M, N, O, R

7. Topics covered: Element synthesis, bonding, crystal structures (directions, planes, x-ray diffraction), silicates, amorphous materials, point defects, solid solutions, dislocations, planar and 3-D defects, defect-property relations, grain structure, microscopy, diffusion (steady-state & non-steady state), mechanical properties, plasticity, hardness, dislocations & slip systems, strengthening mechanisms, recovery-recrystallization-grain growth, fracture, fatigue, ductile-brittle transitions, creep, phase diagrams, Fe-C phase diagram, thermal processing of steel, cast iron, stainless steel, tool steel, nonferrous alloys, corrosion

1. Course number and name
   Mat E 215L Introduction to Materials Science and Engineering I - Lab.

2. Credits and contact hours
   1 credit. 3 hours of lab per week

3. Instructor's or course coordinator's name
   M. (Hogan) E. Martin

4. Text book, title, author, and year
   NONE
   a. other supplemental materials
      Lecture notes and handouts

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Laboratory exercises in materials. [companion course to Mat E 215: Materials Engineering majors only. Structure and properties of ceramic, electronic, polymeric and metallic materials, emphasizing differences based on structure and bonding. Phase equilibria and phase transformations.]

   b. prerequisites or co-requisites
      Credit or Enrollment in MAT E 215 or MAT E 272 or MAT E 392

   c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program
      Required

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.

      Upon completion of this course the student will be able to operate various instruments associated with materials processing and property measurement. Upon completion of this course students will be following best practices in terms of safety and facilities usage and will have established a working community.

   b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      A, B, D, E, G, K, L, M, N, O, R

7. Brief list of topics to be covered

Crystal Structures
Solid solutions and XRD
Young's Modulus
Brittle Fracture – Weibull Modulus
Pb/Sn Phase Diagram
Oral Reports
Gas permeability
Thermal Expansion

1. MAT E 216. Introduction to Materials Science and Engineering II

2. Credits (4), contact hours (5)

3. Instructors: Dr. Alan Constant (lecture) & Prof. Alan Russell (laboratory)

4. Text: Materials Science and Engineering - An Introduction, 8th Ed., W. D. Callister & David G. Rethwisch, 2010

5. Specific course information:
   a. Materials Engineering majors only. Fundamentals of ceramic, polymeric, and composite materials; degradation, electronic, thermal, magnetic, and optical properties of materials. Materials for energy, biomaterials, and nanomaterials. Laboratory exercises in materials property measurements.
   b. Prereq: MAT E 215, Credit or enrollment in PHYS 222
   c. Required

6. Specific goals:

   a. The student will;
      - Be able to identify and classify various materials metals, ceramics, polymers and composites from their characteristic properties (e.g., mechanical, electrical, thermal, magnetic and optical properties)
      - Be able to build a model of a crystal structure given Bravais lattice, lattice parameters and atomic position indices, and identify and sketch planes and directions in simple structures
      - Interpret one- and two-component phase diagrams for ceramic systems and sketch likely microstructures of resulting materials
      - Know how to measure and interpret the meaning of bulk properties of materials such as density, elastic modulus, electrical resistivity, thermal conductivity, magnetic susceptibility.
      - Understand toughening and strengthening mechanisms in ceramic, polymeric and composite materials.
      - Describe conduction mechanisms in metals, semiconductors and insulators and understand methods of engineering the electronic properties in all three classes of materials.
      - Understand the dielectric and optical properties of materials.
      - Know the origins of and magnetism in solids and describe the basic properties of different classes of magnetic behavior in materials.
      - Be able to select candidate materials for particular applications given basic knowledge of materials properties and expected service/environmental conditions

b. Student outcomes

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to communicate effectively
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
- an integrated understanding of the scientific and engineering principles underlying the above four major elements of the field (structure, properties, processing, & performance)
- an ability to utilize experimental, statistical and computational methods consistent with the goals of the program
- to demonstrate hands-on skills with a broad range of modern materials processing and characterization equipment and methods, with special in-depth concentration in two student-selected areas from among ceramic, electronic, metallic, and polymeric materials.

7. Topics covered:

1. Ceramic Materials: Bonding, crystal structures, defects, fracture, stress-strain behavior, phase diagrams.
2. Ceramic Applications and Processing: Glasses, clays, refractories, abrasives. processing and fabrication
3. Thermal Properties: Heat capacity, thermal conductivity, thermal expansion, coefficients of thermal expansion and conductivity.
4. Structure of Polymeric Materials: Bonding of hydrocarbons and polymers, polymerization, molecular weight, molecular structure, cross-linking, crystallinity.
5. Properties of Polymeric Materials: Mechanical properties, glass transition, viscoelelasticity, elastomeric behavior and processing of polymers.
6. Composite Materials: Particle and fiber reinforced systems, rule of mixtures, anisotropy in fiber-reinforced composites.
7. Electronic Properties: Classical conduction model, band theory of electrons in metals, semiconductors, dielectric materials. Electronic properties of metals and alloys. Intrinsic and extrinsic semiconductors. Electronic devices. Dielectric properties; polarization and dielectric constant, ferroelectricity and piezoelectricity.
8. Magnetic Properties: Basic theory of magnetism; spin and orbital angular momentum. Dia-, para-, ferro- and ferrimagnetism, magnetic anisotropy, domains, hard and soft magnetic materials.
9. Optical Properties: EM radiation, refraction, reflection, absorption, transmission, index of refraction color and opacity. Applications.

Mat E 216L – Spring, 2012 Syllabus

1. Mat E 216. Introduction to Materials Science and Engineering II, Laboratory Component

2. Credits = 4; Spring Semester; Laboratory: MWR 3:00-6:00; 3355 Hoover Hall

3. Instructor: Alan Russell, 2220K Hoover Hall (office phone: 294-3204)
office hours: Mon 4-5; Wed 3-4 (other times easily arranged)
russell@iastate.edu home phone: (515) 292-2526

4. Text: Callister & Rethwisch, Materials Science and Engineering: an Introduction, 8th ed., 2010

5. a. Course description: Fundamentals of ceramic, polymeric, and composite materials; degradation, electronic, thermal, magnetic, and optical properties of materials. Materials for energy, biomaterials, and nanomaterials. Laboratory exercises in materials property measurements.

b. Prerequisite: Chemistry 177 or 167
c. Required course

6. a. Specific Goals for the Course: After successful completion of the laboratory component of this course, the student will be able to:

*
Perform a Charpy impact test and interpret the results therefrom

*
Prepare and photograph materialographic specimens

* Perform creep tests on polymers and analyze the results therefrom

*
Predict corrosion performance of galvanic metal couples in aqueous solutions

* Perform mechanical property tests on metals for microhardness, tensile strength/ductility, and strain rate sensitivity

* Perform heat capacity tests on a broad spectrum of materials

b. Student outcomes addressed by the course: A, B, G, K, L, M, O, R

7. Topics covered: Charpy testing, materialography polishing and microscopic examination of specimens, creep testing, corrosion testing, microhardness testing, tensile testing

1. **Course number/name:** Mat E 311 – Thermodynamics in Materials Engineering
2. **Credits and contact hours:** 3 Cr. Lecture; 150 minutes/week; MWF 10-10:50am
3. **Instructor's or course coordinator's name:** Ralph E. Napolitano
4. **Text book, title, author, and year**
   David R. Gaskell, *Introduction to the Thermodynamics of Materials,* 4th ed. Taylor & Francis, New York, NY, 2002.

   Other listed references:
   - C.H.P Lupis, *Chemical Thermodynamics of Materials*, Elsevier Science Publishing Co., New York, NY, 1983.
   - P. Richet, The *Physical Basis of Thermodynamics*, Kluwer/Plenum Publishers, New York, NY, 2001.
   - H.B. Callen, *Thermodynamics and an Introduction to Thermostatistics*, 2nd ed.. John Wiley and Sons, New York, NY, 1995.

5. **Specific course information**
   a. **Brief description of the content of the course (catalog description)**
      Basic laws of continuum and statistical thermodynamics applied to materials systems and chemical reactions: single component and multicomponent phase equilibria, reversible and irreversible processes, solution models, and phase diagrams for materials systems.

   b. **Prerequisites or co-requisites**
      Chem 178 and enrollment in Math 266, or instructor permission.

   c. **Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program**
      Required

6. **Specific goals for the course**
   a. **Specific outcomes of instruction:**

      Students successfully completing this course will be able to:

      - Compute system state properties and transfer quantities (heat and work) associated with changes of state involving closed systems of vapors and liquids.
      - Interpret and use published binary phase diagrams to assess thermodynamic phase stability and chemical solubility as a function of temperature and composition.
      - Implement simple models for chemical thermodynamics to compute binary phase equilibria and associated properties.
      - Interpret and use published ternary phase diagrams, represented in isothermal sections, liquidus projections, and other standard formats.

   b. **Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.**

MSE Program Outcomes expected for Mat E 311	
a.	an ability to apply knowledge of mathematics, science, and engineering
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
k.	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
l.	an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
m.	an integrated understanding of the scientific and engineering principles underlying the four major elements of the field (structure, properties, processing, & performance)
n.	an ability to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems
o.	an ability to utilize experimental, statistical and computational methods consistent with the goals of the program.
p.	mastery of creative, independent, problem solving skills, under time and resource constraints, in a broad range of materials-related applications critical to the success of the final product.

7. Brief list of topics to be covered

The universe, systems, energy, free energy, and the framework of thermodynamics
Historical perspective on thermodynamics
States, state functions, changes of state
Heat, work, mass, 1st, 2nd 3rd laws
Heat capacity, compressibility
Reversible processes, special processes: isometric, isothermal, isobaric, isentropic
Irreversible processes, entropy, degradation, time, and real systems
Entropy of mixing
Auxilliary functions, measurement techniques
Unary systems, phase transitions, Clapeyron, Clausius-clapeyron
Non-ideal gas, partial molar quantities, fugacity,
Virial eqns., Vander Waals gas, critical behavior., compressibility
Gibbs-Duhem Equation and the Gibbs Phase Rule
Binary phase diagrams
Solutions, chemical activity, partial molar quantities, Raoult’s law, Henry’s law
Binary solution models, ideal, regular, subregular, etc.
Interpretation/computation of binary phase diagrams and underlying energetics
Contemporary solution modeling approaches
Interpretation of Ternary phase diagrams, isothermal, liquidus projections

Course Identification: MatE 314 "Kinetics and Phase Equilibria in Materials"
Course contact: 3 contact hours
Instructor: Scott Beckman
Textbook: "*Phase Transformation in Metals and Alloys*," by D. A. Porter, K. E. Easterling, and M. Y. Sherif, 2009
Supplemental Materials: Instructor's notes

Brief description of the content of the course (catalog description)
Kinetic phenomena and phase equilibria relevant to the origins and stability of microstructure in metallic, ceramic and polymeric systems. Application of thermodynamics to the understanding of stable and metastable phase equilibria, interfaces and their effects on stability: defects and diffusion, empirical rate equations for transformation kinetics, driving forces and kinetics of nucleation, diffusional and diffusionless phase transformations.

Prerequisites or co-requisites
The prerequisites to this course are Mat E 216, "*Introduction to Materials Science and Engineering*," and MatE 311, "*Thermodynamics in Materials Engineering*."

Student Enrollment:
This course is required.

Specific goals for the course:
The student will be able to apply the principles of thermodynamics to understand phase equilibria. As part of this the student will understand phase diagrams, diffusion, and material interfaces. The student will use this knowledge to learn about the kinetics of microstructural and phase evolution. The student will understand grain boundary motion, the nucleation process, civilian and military phase transformations.

Student outcomes listed in Criterion 3:

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
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
l. an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
m. an integrated understanding of the scientific and engineering principles underlying the four major elements of the field (structure, properties, processing, & performance)
n. an ability to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems
o. an ability to utilize experimental, statistical and computational methods consistent with the goals of the program.

Brief list of topics to be covered

Thermodynamics and Phase Diagrams

- *Review of thermodynamics*
- *Single component systems*
- *Multi-component systems*
- *Phase diagrams*
- *Gibbs-Thomson effect*

Diffusion

- *Thermodynamic driving force for diffusion*
- *Atomic mechanisms for diffusion*
- *Fick's first and second laws*
- *Common boundary conditions and solutions to Fick's 2nd law*
- *Vacancy assisted diffusion*
- *Darken's equations and the Kirkendall effect*

Interfaces and Microstructure

- *Interface/Boundary energies*
- *Solid/Vapor interfaces*
- *Solid/Solid interfaces (grain boundaries)*
- *Grain boundary stability conditions*
- *Grain boundary motion*
- *Interphase interfaces*
- *Coherent/Semi-Coherent/Incoherent interfaces*
- *Misfit strain and interface dislocation*

Solidification

- *Homogeneous and heterogeneous nucleation*
- *Kinetics of crystal growth*
- *Zone melting purification*
- *Alloy solidification and microstructure*

Diffusional Transformations

- *Homogeneous and heterogeneous nucleation*
- *Diffusion limited interface growth*
- *Kinetics and TTT Curves*
- *Microstructure*

Diffusionless Transformations

- *Twinning*
- *Martensitic Transformations*

1. Course number and name: **MatE 316: Computational Methods in Materials**

2. Credits and contact hours: 3 credits, 4 contact hours per week

3. Instructor's or course coordinator's name: Larry Genalo

4. Text book, title, author, and year: Engineering Statistics by Montgomery, Runger, Hubele; 5th Edition (Hardcopy or Electronic), 2011

   a. other supplemental materials
      Powerpoint notes for all lectures
      JMP software
      Other texts: # 2-6 are the most useful for statistics. # 1 is a review of ENGR160 introduction to statistics only. # 2 was used for Mat E 316 previously. # 3 has been used in other engineering statistics courses at ISU. # 4 is only on the web and includes some hands-on tutorials that allow you to adjust parameters and see the results - its fun - try it. # 5 has been used in graduate level materials statistics courses. # 6 is used for engineering statistics courses at other campuses.

      1. Engineering Fundamentals and Problem Solving, Eide et al, McGraw-Hill, (Statistics Chapter).
      2. Introduction to Probability and Statistics for Scientists and Engineers, Walter A. Rosenkrantz, McGraw-Hill
      3. Statistics for Engineering Problem Solving, Vardeman, PWS
      4. The UCLA Electronic Statistics Textbook, http://www.stat.ucla.edu/textbook/, De Leeuw.
      5. Engineering Design A Materials and Processing Approach, Dieter, McGraw-Hill, Statistics Chapters
      6. Probability and Statistics for Engineering and the Sciences, Devore, Wadsworth

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Use of mathematical and statistical computer tools for materials design and analysis. Applications of statistical principles to problems concerned with materials. Computer-assisted design of experiments.
   b. prerequisites or co-requisites:
   c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.

1. Design experiments that improve the likelihood of statistically significant results that improve the performance of a material or system.

2. In teams and individually, conduct experiments, gather data, analyze data, and report, both orally and written, on the experiment.
3. Apply mathematical software packages and programming concepts (such as finite differencing and finite elements) to solve materials problems (such as diffusion).
4. Use visualization tools in the design, selection, and analysis of materials.
5. Perform and interpret the results of linear regressions, including general response surfaces (Kth order polynomials involving N control variables).
6. Assess the appropriateness for modeling data with a given probability distribution such as Normal, Lognormal, or Weibull.
7. Calculate confidence intervals for sample means and confidence bands for response surfaces.

    b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

a, b, d, e, g, I, k, l, o

7. Brief list of topics to be covered

Data analysis, probability, discrete and continuous random variables, probability plots, central limit theorem, confidence intervals, multiple linear regression, design of experiments – including computer tools, quality control charts, Taylor series approximations, finite differencing, numerical solutions to ODEs and PDEs through finite differencing

1. MAT E 317, Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials.
2. Credits (3), contact hours (3)
3. Instructor: Dr. Alan Constant
4. Text: Principles of Electrical Engineering Materials and Devices, 3rd Edition, S. O. Kasap, McGraw-Hill, 2000.

a. Electronic Properties of Materials, 2nd Edition, Rolf E. Hummel, 1993.
   Electronic Properties of Materials, 6th Edition, Solymar and Walsh, 1998.

5. Specific course information:

a. Introduction to electronic properties of materials and their practical applications. Classical conduction models and electronic properties of metallic and ceramic materials. Elementary quantum mechanics and band theory of electron states in solids. Quantum theory of metallic conduction. Elementary semiconductor theory and devices. Polarization and dielectric properties of materials. Electron conduction in polymeric systems. Magnetic properties and applications of metals and ceramics.
b. *Prereq: MAT E 216 and PHYS 222*
c. *Required*

6. Specific goals for the course:

a. The student will;

- Develop a qualitative and quantitative understanding classical electronic conduction theory. Be able to solve problems using classical model. Discuss effects of solid solutions, ordering and 2 phase alloys.
- Understand the quantum mechanical (QM) approach to describe wave-particle electron duality. Be able to predict behavior of electrons in 1-D quantum-mechanical single electron systems (e.g. step potential, infinite potential well, tunneling etc.) using given solutions to the Schrodinger equation.
- Qualitatively understand the concepts of band structure. Be able to calculate a simple band structure using the 1-D Kroenig-Penny. Qualitatively extend description to describe effects of 2-D and 3-D models.
- Understand the QM description of elastic waves and phonon behavior in materials.
- Understand and be able to calculate Fermi energy and Fermi velocity in materials and use these to reexamine classical metallic conduction.
- Understand the concept of the density of states (DOS) for electrons in a band. Be able to use DOS in materials systems and predict electronic behavior.
- Be able to describe intrinsic and extrinsic behavior in semiconducting materials.
- Develop relationships relating electron density, DOS, mobility, bandgap energy and temperature to conductivity in semiconducting materials
- Understand the concepts of electron and hole conduction and the effects of doping in semiconductors. Mathematically model the simple p-n junction and describe the physics determining the conductivity vs applied potential behavior of this system.
- Be able to describe the atomic and macroscopic dielectric mechanisms (dipole moment, polarization, permittivity) in non-conducting materials. Develop and be able to solve problems using Claussius-Mossotti equation.

- Be able to explain the variation of dielectric constant with temperature and frequency and understand the source of dielectric loss in materials.
- Have a qualitative understanding of two basic types of superconductivity and the effects of the critical temperature, magnetic field and current in those systems.
- Understand the origins of the ferroelectric and piezoelectric effects in materials and describe properties and applications of materials with these properties

b. Student outcomes;

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to identify, formulate, and solve engineering problems.
- the broad education necessary to understand the impact of engineering solutions in a global/societal context
- an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
- an integrated understanding of the scientific and engineering principles underlying the above four major elements of the field (structure, properties, processing, & performance)
- an ability to apply and integrate knowledge from each of the above four elements (structure, properties, processing, & performance) of the field to solve materials selection and design problems
- an ability to utilize experimental, statistical and computational methods consistent with the goals of the program.

7. Topics to be covered:

Classical theory – Conduction in metals, scattering and temperature dependence of resistivity, mixed phases, Nordhiem and Matthiesson rules, Hall Effect, thin film effects. Quantum Theory – Duality in photons and electrons, Pauli Exclusion and Heisenberg uncertainty principles, Schrodinger equation and it’s solutions for six potential environments and the hydrogenic atom. Band Theory (1D, 1 electron) – K-P model. Free electron and nearly free electron models. Electron Statistics – Fermi-Dirac distribution function, density of states (DOS), and the Fermi energy. Band Theory (2D, 3D) – Qualitative extension of 1D model. Phonons – Bosons, heat conductivity, Debye temperature. Metallic Conduction – QM conductivity, phonon scattering and metallic resistance, thermionic emission, Richardson-Dushman equations. Semiconductors – Elemental and compound semiconductors, band structure, intrinsic vs extrinsic behavior, holes/electrons, carrier generation and concentration, mobility, temperature dependence, effective mass, minority carrier lifetime, recombination, hall effect, thermoelectric effect. Semiconductors device physics – Continuity equation, depletion layers, capacitance, Schottky barriers and p-n junction, development of the diode equation, LED’s and solar cells. Semiconductor devices & fabrication techniques. Dielectrics Properties – Dipole moment, polarization, Claussius-Mossotti, frequency dependence, susceptibility/dielectric constant, imaginary dielectric constant and dielectric loss. Dielectric properties of materials, Charge storage, pyro- ,piezo-, and ferrooelectricity. Superconductors – Meissner effect, Type 1 and 2 behavior, critical T, B and I, high temperature SC, qualitative look at BCS Theory.

1. Course number and name
   Mat E 413 Materials Design and Professional Practice I.

2. Credits and contact hours
   3 credits. 2 hours of lecture per week and 2 hours of arranged lab time per week.

3. Instructor's or course coordinator's name
   M. (Hogan) E. Martin and Martha Selby

4. Text book, title, author, and year
   "Materials Selection in Mechanical Design – 4th Ed.", Ashby, M. F., Elsevier Butterworth-Heinemann 2011.
   a. other supplemental materials

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Fundamentals of materials engineering design, information sources, team behavior, professional preparation, quantitative design including finite-element analysis and computer aided design, materials selection, informatics and combinatorial methods. Analysis of design problems, development of solutions, selected case studies. Oral presentation skills. Preparations for spring project.
   b. prerequisites or co-requisites
      Senior status in Mat E
   c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program
      Required

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.

      The student will be able to use a database of materials properties to select materials which are quantitatively best suited to a design application subject to multiple constraints. The student will acquire an understanding of heat flow mechanisms and their relative importances in different scenarios such that design choices can be made which will result in the desired control of heat flows. The student will be able to work with a project sponsor, design a strategy for solving a real-world ongoing problem, develop a planned schedule of sub-tasks in order to implement the designed strategy. The student will be able to communicate their efforts and results in a professional and effective manner.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
   A-P inclusive, R

7. Brief list of topics to be covered

Fundamentals of endeavor: materiel, design, effort

Fundamentals of design: physicality, functionality, context

Application of design and endeavor towards internal project

Examples: maximize the leap of a buoyant object from below water

Maximize the usable heat from a fixed mass of cellulose

Design an experimental protocol for quantifying the amount of heat lost to various mechanism (conduction/convection/radiation/evaporation) from a cup of hot water

Heat exchange

Materials Selection for various applications using CES Edupack Software.

Short term (5 weeks) design projects in teams of 4.

1. Course number and name
   Mat E 414 Materials Design and Professional Practice II.

2. Credits and contact hours
   3 credits. 2 hours of lecture per week and two arranged hours of lab per week

3. Instructor's or course coordinator's name
   M. (Hogan) E. Martin, and Martha Selby

4. Text book, title, author, and year
   NONE
   a. other supplemental materials

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Integration of materials processing, structure/composition, properties and performance principles in materials engineering problems. Multi-scale design of materials, materials processing, case studies including cost analysis, ethics, risk and safety. Team projects specified by either industry or academic partners. Written and oral final project reports
   b. prerequisites or co-requisites
      Senior Status in Materials Engineering
   c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program
      Required

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.

      The student will be able to work with an industrial contact, design a strategy for solving a real-world ongoing problem, develop a planned schedule of sub-tasks in order to implement the designed strategy. Additionally the student will be able to communicate their efforts and results in a professional and effective manner.

   b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
   A-P inclusive, R

7. Brief list of topics to be covered

The topics covered are specific to each project. The projects are typically staffed by 4 students, and a faculty mentor and span approximately 14 weeks.

The students are expected to assume OWNERSHIP of the semester long project – including the organization and execution of literature searches, interviews, experimentation, data analysis, professional communications and site visits.

The main deliverables for the course are weekly reports to instructors and project sponsors, a midterm report to the instructors, and a final report which is delivered to instructors and sponsors.

Project titles from this semester include:
Conformal Coatings for Tin Whisker Growth Inhibition

Spot Test for Chromate Detection on Metal surfaces

Characterization of Track Surfaces for Wheelchair Racing

Corrosion Studies of Al-Ca Composites for Electrical Power Transmission.

Materials for Artificial Soils.

Characterization of Diamond Surfaces.

Properties and Performance of TEPIC (silica filled epoxy) Foam

Stainless Steel Recycling Issues

Galfenol Characterization

Materials for Industrial Textile Application

1. Course number and name: **MatE-418: Mechanical Behavior of Materials**

2. Credits and contact hours: credits 3, contact hours 3 per week

3. Instructor's or course coordinator's name: Ersan Ustundag

4. Text book, title, author, and year: K. Bowman, Mechanical Behavior of Materials, Wiley, 2004
   a. other supplemental materials:
      Additional Resources:
      1. Lecture notes (posted on BlackBoard)
      2. T. H. Courtney, Mechanical Behavior of Materials
      3. M. A. Meyers and K. K. Chawla, Mechanical Metallurgy
      4. G. E. Dieter, Mechanical Metallurgy
      5. R. W. Hertzberg, Deformation and Fracture Mech. of Eng. Materials

5. Specific course information
   a. brief description of the content of the course (catalog description)
      MAT E 418. Mechanical Behavior of Materials. (3-0) Cr. 3. S. Mechanical behavior of ceramics, metals, polymers, and composites. Relationships between materials processing and atomic aspects of elasticity, plasticity, fracture, and fatigue. Life prediction, stress and failure analysis. Nonmajor graduate credit.
   b. prerequisites or co-requisites: 216 and credit or enrollment in EM 324
   c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
   1. an ability to apply knowledge of mathematics, science, and engineering to mechanical behavior of materials
   2. an ability to communicate effectively about the mechanical behavior of materials
   3. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice regarding the mechanical behavior of materials
   4. an ability to apply advanced science (such as chemistry and physics) and engineering principles to the mechanical behavior of materials systems
   5. an integrated understanding of the scientific and engineering principles underlying the four major elements of the field (structure, properties, processing, and performance), as they pertain to the mechanical behavior of materials

6. an ability to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems in the context of mechanical behavior of materials
7. an ability to utilize experimental, statistical and computational methods in solving problems in mechanical behavior of materials

a. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

a, g, k, l, m, n, o.

7. Brief list of topics to be covered

1/9 Introduction	1/11 Introduction (cont.)	1/13 Introduction (cont.)
1/16 No Class (MLK Day)	1/18 Elasticity I	1/20 Elasticity II
1/23 Elasticity III	1/25 Elasticity IV	1/27 Elasticity V
1/30 Plasticity I	2/1 Plasticity II	2/3 Plasticity III
2/6 Plasticity IV	2/8 Plasticity V	2/10 Dislocations I
2/13 Dislocations II	2/15 Dislocations III	2/17 Dislocations IV
2/20 Dislocations V	2/21 Strengthening I	2/24 Strengthening II
2/27 Strengthening III	2/29 Strengthening IV	3/2 Strengthening V
3/5 Review	3/7 Midterm 1	3/7 Midterm 2
3/12 Spring Break	3/14 Spring Break	3/16 Spring Break
3/19 Review of Midterm / Creep I	3/21 Creep II	3/23 Creep III
3/26 Creep IV	3/28 Creep V	3/30 Creep VI
4/2 Fracture I	4/4 Fracture II	4/6 Fracture III
4/9 Fracture IV	4/11 Fracture V	4/13 Fracture VI
4/16 Fracture VII	4/18 Fatigue I	4/20 Fatigue II
4/23 Fatigue III	4/25 Fatigue IV	4/27 Final Review/Course Evaluation

Ceramics Specialty:

1. Course number and name
    a. **MAT E 321. Introduction to Ceramic Science.**
2. Credits and contact hours
    a. Cr. 3. (3-0)
3. Instructor's or course coordinator's name
    a. Kristen P. Constant
4. Text book, title, author, and year
   Fundamentals of Ceramics, (Paperback) Michael Barsoum, IOP Publishing, 2003
      a) other supplemental materials
   Course packet of lecture notes (available in University book store)

5. Specific course information
   a. brief description of the content of the course (catalog description) : Ceramic crystal structures, defects, diffusion and transport. Phase equilibria and microstructures. Powder packing. Thermal, electronic, optical and magnetic properties of ceramics. Nonmajor graduate credit
   b. prerequisites or co-requisites *Prereq: MAT E 216*
   c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program – REQUIRED for Ceramics Specialization, Elective for all others.

6. Specific goals for the course
   a. specific outcomes of instruction,

The student will demonstrate the ability to:

- use an understanding of bonding principles to predict ceramic crystal structures
- identify common ceramic crystal structures including silicates and relate the structure to physical properties
- use Kroger-Vink notation to write defect reactions in stoichiometric and non-stoichiometric ceramics
- describe diffusion mechanisms in ceramics
- interpret binary and ternary ceramic phase diagrams
- calculate thermal stresses and predict thermal shock in ceramics
- calculate dielectric properties for ceramics
- describe how optical and magnetic properties result from electronic structure in ceramics
- describe common applications of ceramic materials and explain which properties are critical to their performance

   b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

   This course has been designed to address the following program outcomes:
   The student will demonstrate

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. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
l an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
m. an integrated understanding of the scientific and engineering principles underlying the four major elements of the field (structure, properties, processing, & performance)

1. Brief list of topics to be covered

- Bonding in Ceramics
- Ceramic Structures
- Thermodynamics and Kinetics wrt Ceramics
- Defects and Diffusion in Ceramics
- Phase Equilibria – binary and ternary
- Thermal Properties of Ceramics
- Dielectric, Magnetic and Optical Properties of Ceramics
- Composite Ceramics
- Applications of Ceramics

1. Course number and name: **Mat E 322: Introduction to Ceramic Processing**

2. Credits and contact hours: **Cr. 3. 2 hours of lecture, 3 hours lab (2-3).**

3. Instructor's or course coordinator's name: **Mufit Akinc**

4. Text book, title, author, and year:
   M. N. Rahaman,
   ***Ceramic Processing and Sintering, Second Edition,* Marcel Dekker, 2003.**
   a. other supplemental materials:
      i) Course notes as provided by the instructor
      ii) Occasional literature posted on the Blackboard

5. Specific course information
   a. brief description of the content of the course (catalog description)
   Raw materials, characterization of ceramic powders and slurries, ceramic foroming methods, and drying. High temperature ceramic reactions, liquid and solid-state sintering, grain growth, microstructure development. Processing / microstructure /property relationships.
   b. prerequisites or co-requisites: **MAT E 215, MAT E 321**
   c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: **Required**

6. Specific goals for the course
   a. specific outcomes of instruction.
   - Ability to calculate batch composition using starting raw materials, formulate raw materials using composition of a ceramic body
   - Ability to determine density (and porosity) of ceramic body, drying and firing shrinkage
   - scientific understanding of rheological behavior of suspensions, predict and control stability of ceramic suspensions,
   - understanding of various forming techniques, the variables that control the properties of the "green" compacts.
   - Ability to select a proper densification method, identify and control the variables that control densification by solid-state and viscous sintering.
   - Ability to conduct experiments, collect data, analyze, interpret the data.
   - Ability to communicate effectively theoretical and practical concepts, findings, and results via written reports.

   b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
      a. An ability to apply knowledge of mathematics, science, and engineering
      b. An ability to design, conduct experiments, as well as analyze and interpret data
      c. An ability to design a system, component, or process to meet the desired needs

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
l. An ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
m. An integrated understanding of the scientific and engineering principles underlying the above
n. four major elements of the field (structure, properties, processing, & performance)
o. An ability to utilize experimental, statistical and computational methods consistent with the goals of the program
r. To demonstrate hands-on skills with a broad range of modern materials processing and characterization equipment and methods, with special in-depth concentration in two student-selected areas from among ceramic, electronic, metallic, and polymeric materials.

7. Brief list of topics to be covered

- Powder Characterization techniques
- Colloidal Phenomena
- Rheology of Ceramic Slips
- Processing Additives
- Sol-Gel Processing
- Shape Forming
- Sintering of Ceramics, Scaling law
- Solid State Sintering (SSS), Initial stage
- Solid State Sintering, Intermediate Stage
- Solid State Sintering, Final Stage
- Liquid Phase Sintering
- Microstructure, Grain Growth
- Hot Pressing

1. **Course number and name:** MAT E 425. Glasses and Advanced Ceramics

2. **Credits and contact hours:** (2-3) Cr. 3.

3. **Instructor's or course coordinator's name:** Steve W. Martin

4. **Text book, title, author, and year:** "Fundamentals of Inorganic Glasses," 2nd, Edition, Arun Varshneya, Society of Glass technology, 2006

5. **Specific course information**
   a. **Brief description of the content of the course (catalog description)**
      Composition, structure, properties and manufacturing of inorganic glasses and Ceramics. Properties and applications of advanced ceramics. Structural, thermal, optical, electronic, magnetic and biological applications of ceramic materials. Contemporary topics in ceramic engineering. Laboratory exercises in preparation and characterization of glasses and advanced ceramics. Nonmajor graduate credit.

   b. **Prerequisites or co-requisites**
      MatE 321

   c. **Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program**
      Required course for Ceramics Specialization, selected elective for students not specializing in Ceramics

6. **Specific goals for the course**
   a. **Specific outcomes of instruction**

      To become familiar with common commercial glasses and ceramics and their uses. To be able to use this knowledge to select specific glasses and ceramics for specific applications

      To learn the general features of glass and ceramic science and engineering as it relates to glass and ceramic structure and the dependence of physical properties upon glass and ceramic processing. To be able to use this knowledge to predict the behavior of glass and ceramics in many commercial and technical applications so as to optimize the glass and ceramics for the application and to understand and be sensitive to the possible modes of failure of glass and ceramics in these applications.

      To learn the general properties of glass and ceramics and how these properties are related to glass and ceramic composition. To be able to use this knowledge to develop and recommend certain and specific glass and ceramic compositions for technical, commercial and residential applications and to understand and be sensitive to the limitations of glass and ceramics and possible modes of failures in these applications.

To learn many of the commercial manufacturing practices used in making and processing glass and ceramics. To be able to use this knowledge to be confident in beginning work for a glass and ceramics or glass and ceramics related company and/or manufacturing concern in all areas of the glass and ceramics plant, from the hot end (forming) through to the cold end (packaging).

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Objectives: A, C, E Outcomes: a-e, g, j-o, r (significant), f, h, i (moderate)

7. Brief list of topics to be covered

Introduction to and general features of glass; Composition of typical commercial glasses and ceramics; Fundamentals of the glassy (vitreous) state; Conditions for glass formation; Liquid immiscibility and phase separation; Survey of glass structure and composition relations; Physical Properties of Glass; Thermal properties; Electrical properties; Mechanical properties; Optical properties; Chemical Durability; Glass Engineering and Manufacturing; Raw materials; Compositions and batching; Furnaces and fuels; Glass melting; Glass forming and processing; Annealing and strengthening; Inspection and Quality Control.

Electronic Materials Specialty:

1. MAT E 334 Electronic & Magnetic Properties of Metallic Materials
2. Credits (3), contact hours (4)
3. Instructor: Dr. Alan Constant
4. Textbook: Elementary Solid State Physics, Principles and Applications, M. Ali Omar, Addison Wesley, 1978,

a. Electronic Properties of Materials, 2nd Edition, Rolf E. Hummel, 1993.
Principles of Electrical Engineering Materials and Devices, 3rd Edition, S. O. Kasap, McGraw-Hill, 2000.
Electronic Properties of Materials, 6th Edition, Solymar and Walsh, 1998.
Solid State Physics, G. Burns, 1990.
The Solid State, 3rd Edition, H.M. Rosenberg 1992.

5. Specific course information:

a. Electronic conduction in metals and the properties of conducting materials. Quantum mechanical behavior of free electrons and electrons in potentials wells, bonds and lattices. Development of the band theory of electron states in solids and the Free and Nearly Free Electron models. The density-of-states in energy bands and the Fermi-Dirac statistics of state occupancy. Quantum mechanical model of metallic conduction; Brillouin zones and Fermi surfaces. Additional topics include the thermal properties of metals, phase transitions in metallic alloys and the BCS theory of superconductivity. Quantum mechanical treatment of the origins of magnetism in materials; orbital and spin angular momentum. Theory of magnetic behavior in dia- and para-magnetic materials, ferromagnetic behavior and the exchange interaction. Domain structure and hysteresis.
b. Prereq: MAT E 317
c. Required for electronics option, technical elective.
d. Specific goals for the course: The student will:

- Understand the basics of wave equations and how to solve them.
- Describe, understand and be able to solve problems concerning the quantum mechanical nature of electrons.
- Derive and solve the Schrodinger equation for an electron in a variety of potential environments. Understand the solution to the hydrogenic atom model and solve problems concerning the energy states and angular momenta of electrons in this system. Extend, conceptually, this understanding to multi-electron atomic systems.
- Be able to describe the role of the QM behavior of electrons in bonding.
- Derive, understand and solve problems using the free electron (FE) model for conductors. Be able to interpret the E-k dispersion curve for free electrons.
- Derive, understand and solve problems concerning elastic and EM waves in lattices. Understand the nature of phonons and the Debye temperature and the lattice diffraction conditions and for phonons and photons. Understand the dispersion curve for elastic waves in lattices.
- Derive, understand and solve problems using the nearly free electron (NFE) model for conductors. Derive and employ the Kronig-Penny (KP) Model and Bloch function to describe the existence of energy band gaps in the E-k dispersion curves.

- Computationally recreate the KP model and plot a 1-D dispersion curve.
- Derive and use the density of states function (DOS) to calculate the Fermi energy in conductors. Be able to calculate the DOS in any energy range in a band.
- Understand the diffraction conditions for electrons in 1,2 and 3D lattices, and the nature of the Brillouin zone. Be able to plot 2D lattices and Fermi surfaces in reciprocal space. Qualitatively understand the 3D Fermi surfaces of conductors and predict electronic properties based on the features of individual Fermi surfaces.
- Derive and understand the Hume-Rothery phase transition rules for noble metal alloy systems.
- Describe and understand superconductivy and the BCS theory.
- Describe, understand and be able to solve problems concerning the origins of magnetic properties in materials.
- Describe and understand the Langevin models for diamagnetism and paramagnetism in solids.
- Describe and understand the mechanism for ferro and ferri-magnetism in materials. Qualitatively understand the origins of the exchange interaction. Be able to perform simple computations of saturation magnetization in these systems. Understand the hysteresis effect and domain walls in ferromagnetic materials.

e. Student outcomes:

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to identify, formulate, and solve engineering problemsa recognition of the need for and an ability to engage in life-long learning
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
- an integrated understanding of the scientific and engineering principles underlying the above four major elements of the field (structure, properties, processing, & performance)
- an ability to utilize experimental, statistical and computational methods consistent with the goals of the program

7. Brief list of topics to be covered: Review of vector analysis, Maxwell's equations and 1-D wave equation. Particle & wave description of the electron, uncertainty, Fermi-Dirac statistics. Behavior electrons in potential fields, atoms and bonds. Behavior of electrons in lattices: Free Electron, Nearly Free Electron models, Kronig-Penney model, Conductivity, effective mass, band diagrams, density of states, Fermi energy and surfaces. Quantum oscillators & phonons. Fermi surfaces and conductivity in monovalent, divalent, trivalent metals, and doped semiconductors. Phonon scattering. Hole and electron like behavior. Phase transitions in metallic systems (Hume Rothery – rules). Superconductyivity and BCS theory. Origins of magnetic behavior in solids, Langevin development of dia- and paramagnetism. Forms of ferro- and ferri-magnetism, exchange interaction, magnetic order, domain walls and hysteresis.

Mat E 332 is a cross-list of EE 332, taught by EcPE Department

1. Mat E 433 Advanced Electronic Materials

2. Credit: 3
   MF 9:00 – 9:50AM lecture
   W 9:00AM – 5:00PM lab

3. Instructor: Xiaoli Tan
   xtan@iastate.edu
   2220G Hoover Hall
   Phone: 294-3355

4. Text book: A.J. Moulson & J.M. Herbert, Electroceramics, 2nd Ed., Wiley, 2003.
   a. Reference: S. Kasap, Principles of electrical engineering materials and devices, McGraw-Hill, 2002.
   b. Other supplemental materials posted on class webpage

5. Specific course information
   a. Brief description of the content of the course: Advanced concepts in band theory of solids including chemical bonding in solids and the linear combination of atomic orbitals, phase transitions in electronic, magnetic, and optical materials. Dielectric materials, ferroelectricity, piezoelectricity, sensors, and non-stoichiometric conductors. Optical properties, optical spectra of materials, optoelectronic devices. Magnetic and superconducting materials. Nonmajor graduate credit.
   b. Prerequisite: Mat E 334
   c. Required for Electronic Materials specialization

6. Specific goals for the course
   Specific outcomes of instruction
   1) Explain the concept of point defects and use the Kröger-Vink notation to describe them.
   2) Use defect reactions to interpret electrical conductivity of crystalline ceramic compounds.
   3) Calculate electrical conductivity of mixture phases.
   4) Understand electronic, ionic and polaron conduction mechanisms.
   5) Select conducting materials for various applications.
   6) Explain mechanisms for chemical sensors based on solid electrolytes, and electronically conducting ceramics.
   7) Understand the conducting mechanism in conjugated polymers and describe the superconducting phenomenon in metals and oxides.
   8) Explain the concepts of dielectric permittivity, electric dipole moment, dielectric polarization, dielectric susceptibility, dielectric loss.
   9) Explain the resonance, and relaxation process of dielectrics under a.c. field.

10) Predict dielectric permittivity of mixture of phases.
11) Explain the concepts of ferroelectricity, spontaneous polarization, remanent polarization, coercive field, Curie-Weiss law, ferroelectric domains, domain polarization switching, poling processing, hysteresis loops.
12) Explain the effects of chemical doping, compositional heterogeneity, grain size, bias field on ferroelectric properties.
13) Understand the dielectric breakdown mechanisms in insulating materials.
14) Evaluate the volumetric efficiency, maximum energy density, equivalent parallel and series resistance of capacitors.
15) Select different types of capacitors for different applications.
16) Explain the strategy for suppressing conductivity in multilayer capacitors with base-metal electrodes.
17) Calculate capacitance variation as a function of temperature and design materials with zero temperature coefficient.
18) Describe piezoelectricity in terms of a set of thermodynamic variables and coefficients.
19) Calculate mechanical strain and electrical potential difference with piezoelectric coefficients.
20) Explain the structure and property of lead zirconate titanate ceramics and their piezoelectric applications.

6. Explicitly indicate which of the student outcomes listed in Criterion 3 are addressed by the course
   a, b, c, h, j, l, n, o

7. Brief list of topics to be covered
   a. Crystal defects in crystals (Kröger-Vink notation, defect reaction)
   b. Electrical conduction in solids
      i. Electronic conduction (Gas sensors)
      ii. Ionic conduction (Fuel cells)
      iii. Conducting ceramics
      iv. Conducting polymers
      v. Superconductors
   c. Review of electrostatics
   d. Charge displacement in solids
   e. Dielectrics and insulators (Microwave applications)
   f. Capacitors (Multilayer capacitors)
   g. Ferroelectricity
   h. Piezoelectricity
   i. Magnetic and optical properties of materials

Metals Specialty:

1. Mat E 342. Structure-property Relations in Nonferrous Metals

2. Credits = 3; Spring Semester; Lecture-Recitation: MF 2:10-3:00; 1304 Howe Hall; Laboratory: W 2:10-3:000; 3355 Hoover Hall

3. Instructor: Alan Russell, 2220K Hoover Hall (office phone: 294-3204)
office hours: Mon 4-5; Wed 3-4 (other times easily arranged)
russell@iastate.edu home phone: (515) 292-2526

4. Text: Russell & Lee, Structure-property Relations in Nonferrous Metals, 2005

5. a. Course description: Processing of metals and alloys to obtain desired mechanical properties by manipulation of their microstructure and composition of constituent phase(s). Relevance of defects to mechanical properties, plastic flow. Strengthening mechanisms in metals and alloys. Microstructure, heat treatment and mechanical properties of engineering alloys. Metal-matrix composites. Nonmajor graduate credit.
b. Prerequisites: Mat E 215 and 272 (Mat E 273 may substitute for Mat E 272.)
c. Required course for Metals Specialization

6. a. Specific Goals for the Course: After successful completion of this course, the student will be able to:

- predict general physical properties of a metallic element from its position in the periodic table of the elements
- specify changes in composition and/or heat treatment that will modify a metal's properties to optimize them for a particular application
- select appropriate nonferrous alloys for engineering applications that require a combination of properties (e.g., density, yield strength, fracture toughness, oxidation resistance, fabricability, cost)
- predict how particular metal properties will be altered by changes in factors such as operating temperature, prior cold work, presence of interstitial impurities, grain size and structure, precipitated second phases, and radiation damage
- make an informed choice between conventional alloys, composites, and intermetallic compounds when specifying material for a given application

b. Student outcomes addressed by the course: A, B, C, E, G, K, L, M, N, O, R

7. Topics covered: Crystal structures, strengthening mechanisms, dislocations, fracture, fatigue, deformation maps, strain rate effects and creep, nanocrystalline metals, quasi-crystals, amorphous metals, radiation damage, composites, alkali metals, alkaline metals, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Co, Ni, platinum group metals, Cu, Ag, Au, Zn, Cd, Hg, Al, Ga, In, Tl, Si, Ge, Sn, Pb, rare earth metals, actinide metals, intermetallic compounds

1. **Course number/name:** Mat E 443 – Physical Metallurgy of Ferrous Alloys
2. **Credits and contact hrs:** 2 Cr.Lect., 1 Cr.Lab; 100 min/wk lecture, 3 hrs/wk lab
3. **Instructor's or course coordinator's name:** Ralph E. Napolitano
4. **Text book, title, author, and year**
   George Krauss, *Steels: Heat treatment and processing principles,* ASM International, Materials Park, OH, 1990.

5. **Specific course information**
   a. **Brief description of the content of the course (catalog description)**
      Production and processing of ferrous metals, physical chemistry and extraction of iron from ore, physical chemistry of steelmaking processes, equilibrium and nonequilibrium phases in the Fe-C system, heat treatment of steels and control of phase transformations, property- processing-microstructure relationships, transformation kinetics, casting, forging, rolling, quenching, and tempering, as they apply to ferrous metals.
   b. **Prerequisites or co-requisites**
      Prereq. MatE 212 and 214 or instructor permission.
   c. **Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program**
      Required (for metals specialization)

6. **Specific goals for the course**
   7. **Specific outcomes of instruction:**

      Students successfully completing this course will be able to:

      - Specify and interpret primary and secondary processing routes, and assess effects on structure and properties (smelting, refinement, remelt/purification, degassing, casting, forming, heat treating, joining);
      - Interpret microstructures and relate to heat treatment and composition.
      - Compute aspects of phase transformation kinetics and design processes to obtain desired structures and/or properties.
      - Interpret and use published heat treatment information to design processes for specific applications.
      - Prepare metallographic specimens and perform analyses of microstructural, microchemical, and mechanical properties.

   8. **Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.**

MSE Program Outcomes expected for Mat E 443	
a.	an ability to apply knowledge of mathematics, science, and engineering
b.	an ability to design and conduct experiments, as well as to analyze and interpret data

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
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
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
l. an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
m. an integrated understanding of the scientific and engineering principles underlying the four major elements of the field (structure, properties, processing, & performance)
n. an ability to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems
o. an ability to utilize experimental, statistical and computational methods consistent with the goals of the program.
p. mastery of creative, independent, problem solving skills, under time and resource constraints, in a broad range of materials-related applications critical to the success of the final product.

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7. Brief list of topics to be covered

Recovery of iron from ore: raw materials, blast furnace, scrap utilization
Steelmaking processes: Bessemer, Open Hearth, Basic Oxygen, Electric-arc furnace
Control of melt chemistry, remelting processes: VIM, AOD, VAR, ESR, etc.
Casting processes, continuous, ingot, degassing, cast structures
Forming processes, product forms, joining processes, welded structures
Fe-C phase diagram: phases, microstructures, transformations
Nucleation kinetics, growth kinetics, eutectoid & proeutectoid structures
pearlite, cementite, ferrite
Martensite mechanisms distortion, slip, twinning, bainite, retained austenite
Isothermal and continuous cooling transformations, overall transformation kinetics
Harness and hardenability, critical diameter, quench severity, Jominy testing
Tempering, secondary hardening, maraging, embrittlement
Carburizing and surface hardening
HSLA steels, alloy steels, stainless steels, tool steels, cast irons

1. Course Title: Mat E 444 Corrosion and Failure Analysis

2. Credit and Contact Hours: 3 credits, 4 contact hours

3. Instructor: S. Chumbley

4. Textbook: Understanding How Components Fail, D. J. Wulpi, 2nd edition, ASM International, 2000
    a. Denny A. Jones, Principles and Prevention of Corrosion, 2nd Edition, Prentice Hall, NJ, 1996

5. Specific course information
    a. (2-2) Cr. 3. S. *Prereq: 216 and credit or enrollment in 418*
    Corrosion and corrosion control of metallic systems. Corrosion fundamentals, classification of different types of metallic corrosion, corrosion properties of various engineering alloys, corrosion control. Failure analysis. Characteristics of common types of metallic failures, case studies of failures, designing to reduce failure risk. Nonmajor graduate credit.prerequisites or co-requisites
    b. Required for Metals Specialty, elective for others in the program

6. Specific goals for the course
    a. The student will be able to 1) develop a systematic methodology for approaching the analysis of a failure; 2) be able to identify the most common types of failures including corrosive attack; 3) deduce the stress state and/or corrosive environment that lead to the failure; 4) reduce possible failure through a proper combination of part design and material selection.
    b. Addresses ABET Criteria: A, B, G, K, L, M, O, R

7. Brief list of topics to be covered

    Analyzing a Failure: methodology, techniques

    Mechanical Property Aspects of Failure: stress states, fracture mechanics, mechanical properties

    Types of Failure: distortion and fracture; brittle, ductile, fatigue, wear; corrosion

    Electrochemistry of Corrosion: fundamentals of corrosion; galvanic series, oxidation / reduction reactions, corrosion rates, passivity

    Metallic Corrosion: types of corrosion; identifying characteristics

    Methods of Corrosion Control: design; inhibitors, cathodic protection, coatings

Polymers Specialty:

1. Course number and name
   Mat E 351 – Introduction to Polymeric Materials

2. Credits and contact hours
   3 credits. 3 hours of lecture per week

3. Instructor's or course coordinator's name
   M. (Hogan) E. Martin

4. Text book, title, author, and year
   Paula Yurkanis Bruice, *Essential Organic Chemistry*, Prentice Hall, 2006.
   Joel R. Fried, *Polymer Science and Technology, 2nd edition*, Prentice Hall, 2003.
    a. other supplemental materials

5. Specific course information
    a. brief description of the content of the course (catalog description)
       Introduction to polymeric materials, synthesis, structure and properties. Relationship between polymer composition, processing and properties
    b. prerequisites or co-requisites
       Mat E 216
    c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program
       Selected Elective

6. Specific goals for the course
    a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
       1 Be familiar with chemical structure and chemical formulas of polymeric materials
       2 Be able to distinguish different polymerization reactions and mechanisms
       3 Be able to develop an understanding of the physical properties of polymers and how they relate to polymer microstructure

    b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
       A,H,J,K,L,M,N,O

7. Brief list of topics to be covered

Lecture 1. Electronic Structure and Covalent Bonding
Lecture 2. An Introduction to Organic Compounds

Lecture 3. Alkenes: Structure, Nomenclature, Stability, and an Introduction to Reactivity
Lecture 4a. Aromaticity; 4b. Alcohols, Amines, Ethers, and Epoxide
Lecture 5. Carbonyl Compounds: carboxylic acids, esters, amides, etc.
Lecture 6. Introduction to Polymers
Lecture 7. Molecular Weight (MW) and MW Distribution
Lectures 8-9. Step-Growth Polymerization
Lectures 10-12. Chain Growth Polymerization (CGP) • Free Radical CGP • Ionic CGP • Coordination CGP
Lecture 13. Polymer Conformation
Lectures 14-17. • Thermodynamics of Polymer Solution • Thermodynamics of Polymer Blends

1. Mat E 453 Physical and Mechanical Properties of Polymers

2. 3 credits, lectures on Tuesdays and Thursdays from 8:00 a.m. – 8:50 a.m. and lab at an assigned time

3. Dr. Michael Kessler

    1. Fried, J. R. Polymer Science and Technology, 2nd Ed., Prentice Hall, Upper Saddle River, NJ, 2003.
        a. Rosen, S. L. Fundamental Principles of Polymeric Materials, 2nd Ed., John Wiley and Sons, New York, 1993
        b. Kumar, A., and Gupta, R. K., Fundamentals of Polymer Engineering. 2nd ed., Marcel Dekker, Inc., New York, 2003.

4. Specific course information
    a. Overview of polymer chemical composition, microstructure, thermal and mechanical properties, rheology, and principles of polymer materials selection. Intensive laboratory experiments include chemical composition studies, microstructural characterization, thermal analysis, and mechanical testing.
    b. Prerequisite: Mat E 351
    c. Selected elective

5. Specific goals for the course
    a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
        - The student will be able to describe the differences between addition/chain growth polymerization and condensation/step growth polymerization.
        - The student will be able to describe how molecular weight is characterized experimentally and determine weight average and number average molecular weight from experimental data.
        - The student will be able to analyze FTIR spectra from polymer samples and interpret chemical structure from the data.
        - The student will be able to describe physical and morphological behavior of semi-crystalline polymers and use tools such as X-ray diffraction and polarized optical microscopy to elucidate the structure of these materials.
        - The student will be able to describe stress strain behavior and mechanisms of deformation for several types of polymers.
        - The student will be able to communicate effectively through written formal lab reports, memo reports, web page reports, and oral presentations as part of lab teams from various backgrounds.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

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
L. an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
M. an integrated understanding of the scientific and engineering principles underlying the above four major elements of the field (structure, properties, processing, & performance)
N. an ability to apply and integrate knowledge from each of the above four elements (structure, properties, processing, & performance) of the field to solve materials selection and design problems
O. an ability to utilize experimental, statistical and computational methods consistent with the goals of the program
R. to demonstrate hands-on skills with a broad range of modern materials processing and characterization equipment and methods, with special in-depth concentration in two student- selected areas from among ceramic, electronic, metallic, and polymeric materials.

6. Brief list of topics to be covered
   - Step-Growth and Chain Growth Polymerization
     - Lab 1: Synthesis of PS and Nylon 6,6
   - Molecular Weight
     - Lab 2: Gel Permeation Chromatography
   - Chemical Structure Determination
     - Lab 3: Fourier Transform Infrared Spectroscopy
   - Thermal Transitions in Polymers
     - Lab 4: DSC
   - X-ray Diffraction of Polymers
     - Lab 5: Wide Angle X-Ray Diffraction
   - Semi-Crystalline Polymers
     - Lab 6: Polarized Optical Microscopy
   - Mechanical Properties of Polymers
     - Lab 8: Tensile Testing
     - Lab 10: TGA
   - Viscoelasticity and Dynamic Mechanical Analysis
     - Lab 9: DMA
   - Polymer Rheology
     - Lab 11: Rheology
     - Lab 7: Injection Molding

1. Mat E 454 – Polymer Composites and Processing

2. 3 credits, Tuesdays and Thursdays from 2:10 p.m. – 3:30 p.m.

3. Dr. Michael Kessler

4. Mat E 454 Coursepack which contains the following material:
    a. Pages 3-67 and 78-80 of L. Sperling, Polymeric Multicomponent Materials, John Wiley, NY, 1997.
    b. Pages 2-55 of Donald F. Adams, Leif A. Carlsson, R. Byron Pipes. Experimental Characterization of Advanced Composite Materials. 3rd ed., CRC Press, Boca Raton, 2003.
    c. Pages 18-42, 63-97, 158-203 of Daniel, Isaac M. and Ori Ishai. Engineering Mechanics of Composite Materials. 2nd ed., Oxford UP, NY. 2006.

    References:
    a. Daniel Miracle and Steven Donaldson eds., ASM Handbook–Composites, ASM International Vol. 21. Materials Park, OH, 2001 (Available online through ISU at http://products.asminternational.org/hbk)
    b. Michelle M. Gauthiered., Engineered Materials Handbook Desk Edition, ASM International. Materials Park, OH, 1995 (Available online through ISU at http://products.asminternational.org/hbk)

5. Specific course information
    a. Basic concepts in polymer composites, blends, and block copolymers. Phase separation and miscibility, microstructures and mechanical behavior. Fiber reinforced and laminated composites. Viscosity, rheology, viscoelasticity of polymers. Polymer melt processing methods such as injection molding and extrusion; selection of suitable processing methods and their applications.
    b. Prerequisite: Mat E 351
    c. Selected elective

6. Specific goals for the course
    a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
        - The student will be able to characterize composite materials based on the form of the reinforcement and type of matrix.
        - The student will be able to identify and interpret data showing polymer transitions (such as melting and glass transition) and understand how these transitions are effected in polymer blends and other two phase systems.
        - The student will be able to model multicomponent behavior in composite materials using various micromechanical models.
        - The student will understand how processing viscosity and volume fraction influence phase continuity in polymer blends.

- The student will be able to communicate effectively in written and oral reports/presentations on the topic of polymer composites and processing.
- The student will be able to apply the laws of thermodynamics to polymer solubility and mixing problems.
- The student will be able to calculate the stress-strain behavior of composite laminates using laminate plate theory and computer simulation tools.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

7. A. an ability to apply knowledge of mathematics, science, and engineering
8. B. an ability to design and conduct experiments, as well as to analyze and interpret data
9. D. an ability to function on multi-disciplinary teams
10. G. an ability to communicate effectively
11. J. a knowledge of contemporary issues
12. K. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
13. L. an ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems
14. M. an integrated understanding of the scientific and engineering principles underlying the above four major elements of the field (structure, properties, processing, & performance)
15. N. an ability to apply and integrate knowledge from each of the above four elements (structure, properties, processing, & performance) of the field to solve materials selection and design problems

7. Brief list of topics to be covered

- Introduction to Polymer Composites
- Basic Concepts in Multicomponent Polymer Materials
- Modeling Multicomponent Behavior and Micromechanics
- Phase Continuity and Phase Diagrams
- Polymer Solubility and Thermodynamics of Mixing
- Fracture Behavior
- Constituent Materials in FRPs
- Composite Laminates
- Laminated Plate Theory for FRP
- Polymer and Composites Processing

Appendix B – Faculty Vitae

1. Name
   Mufit Akinc
2. Education – degree, discipline, institution, year
   Post-doc, Materials Science Division, Argonne National Lab, Argonne, Il. 1977.
   Ph.D. Ceramic Engineering, ISU, Ames, IA, 1977
   M.S. Chemistry, METU, Ankara, Turkey, 1973
   B.S. Chemistry, METU, Ankara, Turkey, 1970
3. Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 1990-1995), full time or part time

2012-present	Professor, Chemical and Biological Engineering, ISU
2006-present	Professor, Materials Science & Engineering Dept., ISU
1998-2003	Chair, Materials Science and Engineering, NTU
1995-2006	Professor & Chair, Materials Science & Engineering Dept, ISU
1997-present	Adjunct Professor, Department of Chemistry, METU, Turkey
1988-95	Professor, Materials Science & Engineering Dept., ISU
1985-88	Associate Professor, Materials Sci. & Engr. Dept., ISU
1981-85	Assistant Professor, Materials Sci. & Engr. Dept., ISU
1979-81	Chair, Dept. of Applied Chemistry, METU, Gaziantep, Turkey.
1977-79	Assistant Professor, Chem. Engr. Dept. Kansas State University.

4. Non-academic experience – company or entity, title, brief description of position, when (ex. 1993-1999), full time or part time

1996 & 2000	Adjunct Scientist, ONR International Field Office
1992-93	Liaison Scientist, ONR European Office
1989-present	Associate, Ames Laboratory

5. Certifications or professional registrations
   None
6. Current membership in professional organizations
   American Ceramic Society, Fellow
   American Society of Materials, Fellow
   American Association for the Advancement of Science, Fellow
   European Academy of Sciences, Member
7. Honors and awards
   Visiting Professor, Warsaw University of Technology, May 2010.
   International Service Award, Iowa State University, 2009
   Visiting Professor, Koc University, Istanbul, Turkey, Fall 2008
   Fulbright Scholar, Fulbright Lectureship Award, 2008
   Member, Board of Trustees, ASM International, 2008-2011
   Ross Coffin Purdy Award, American Ceramic Society, 2006
   International Advisor, National Institute of Materials Science of Japan, 2006-2010
   Outstanding Service Award, MSE Department, 2004
   Visiting Professor, Koc University, Istanbul, Turkey 2004
   Member, Executive Council, 2002-04, V. Chair, UMC, 2005
   Member, **European Academy of Sciences**, 2003
   Faculty Citation, Iowa State University, 2001

Fellow, American Ceramic Society, 1996
Ceramic Science Expert to Government of Turkey, TOKTEN, UN, 1992, 1998
Ceramic Science Expert to Government of Korea, UNIDO, 1989

8. Service activities (within and outside of the institution)
   Member, Bradley Stoughton Award For Young Teachers Selection Committee, ASM International
   Member, Board of Directors, Fulbright Association, Iowa Chapter
   Member, Board of Trustees, ASM International 2008-2011
   Vice Chair, University Materials Council, 2005
   2nd Vice Chair, University Materials Council, 2004
   Counselor, University Materials Council, May 2002-2004
   President's Faculty Advisory Board, American Ceramic Society, 1997
   Associate Editor, J. American Ceramic Society, 1994-96
   Co-Chair and Organizer, International Workshop on Processing of Colloidal and Nano-scale Processing of Ceramics, May 21-22,1993, Saarbrucken, Germany
   Co-chair and Organizer, International Workshop on Ceramic Science and Technology, July 20-21, 1993 METU, Ankara, Turkey.
   Co-Chair and Organizer, Symposium on Ceramic Processing, Fine Particle Society, Las Vegas, NV, June 13-15, 1992
9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation
   - M. Thunga, A. Bauer, K. Obusek, R. J. Meilunas, Z. Olshenske, M. Akinc, M. R. Kessler,"Repair of High Temperature Polymer Matrix Composites Using Low Viscosity Cyanate Ester Resin," *SAMPE* 2012 (submitted).
   - Md. Imteyaz Ahmad, Gaurav Mohanty, Lee R. Cambrea, Daniel C. Harris, Krishna Rajan, Mufit Akinc, "Crystal Growth of ZrW_2O_8 and its Optical Na Mechanical Characterization," *J. Crystal Growth*, 2011 (Accepted).
   - Md. Imteyaz Ahmad, K. Lindley, And M. Akinc, "Hydrothermal Synthesis of Zr2-δMoδO8 (δ=0-0.91) and its α→β Transformation, *J. Am. Ceram. Soc.*, 94(8), 2619-2624, 2011.
   - P. Badrinarayanan, Md. I. Ahmad, M. Akinc, and M. R. Kessler, "Comparison of Negative Thermal Expansion in Zirconium Tungstate Nanoparticles with Different Morphologies" *Materials Chemistry and Physics,* 131[1-2], 12-17, 2011.
   - X. Pang, L. Zhao, M. Akinc, J. K. Kim, Z. Lin, "Novel Amphiphilic Multi-Arm, Star-Like Block Copolymers as Unimolecular Micelles," *Macromolecules*, 44(10), 3746-3752, 2011.

10. Briefly list the most recent professional development activities.

1. Name: Iver Anderson

2. Education – Ph.D., Metallurgical Engineering, University of Wisconsin, 1982, J.H. Perepezko-advisor. M.S., Metallurgical Engineering, University of Wisconsin, 1977, J.H. Perepezko-advisor. B.S., Metallurgical Engineering, Michigan Tech. University, 1975

3. Academic experience –

1994-present	Adjunct Professor, Materials Science and Engineering Department (MSE), Iowa State University (ISU)
1987-present	Principal Investigator, Institute for Physical Research and Technology (IPRT), ISU
1991-present	Senior Metallurgist, Materials and Engineering Physics Program, Ames Laboratory, IPRT, ISU
1997 to 2001	Program Director, Metallurgy and Ceramics Program, Ames Laboratory, IPRT, ISU
1991-1994	Adjunct Associate Professor, MSE, ISU
1989-1991	Adjunct Assistant Professor, MSE, ISU
1987-1991	Metallurgist, Metallurgy & Ceramics Program, Ames Laboratory, IPRT, ISU
1982-87	Staff Metallurgist, Materials Science and Technology Division, U.S. Naval Research Laboratory

4. Non-academic experience –
   Memberships: Federation of Materials Societies (FMS), The Metals, Minerals, and Materials Society (TMS), ASM International, American Powder Metallurgy Institute (APMI), American Welding Society (AWS), American Ceramics Society (ACerS)
   Professional Society Offices & Committees: FMS President (2002-2004), TMS Materials and Society Committee (Chair), TMS Board of Directors (past member), TMS Public and Governmental Affairs Committee (past Chair), TMS Materials Processing and Manufacturing Division (past Chair), TMS Particulate Materials Committee (past Chair), TMS Synthesis and Analysis in Materials Processing Committee (past Chair), TMS Solidification Committee (member), ASM Nominating Committee (member), ASM Energy Committee (member), ASM Materials Science Division Council (past Chair), APMI Board of Directors (past member), Editorial Review Committee of "International Journal of Powder Metallurgy" (member).

5. Certifications or professional registrations:

6. Current membership in professional organizations

7. Honors and awards
   2010 Iowa State University Intellectual Property Award
   2010 Federal Laboratory Consortium Award for Excellence in Technology Transfer
   2008 Distinguished Scientist/Engineer from EMPM Division of TMS

2008 Excellence in Research Award from MSE Department of ISU
2006 Iowa Inventor of the Year
2006 Fellow of APMI International
2001 Energy 100 Award
1996 TMS Distinguished Service Award
1994 Fellow of ASM International
1991 R&D-100 Award
1991 Federal Laboratory Consortium, Award for Excellence in Technology Transfer

8. Service activities (within and outside of the institution)

9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation
    a) A.J. Boesenberg, I.E. Anderson, and J.L. Harringa, "Development of Sn-Ag-Cu-X Solders for Electronic Assembly by Micro-Alloying with Al," JEM, (2012) 41, no. 3, (in print).
    b) I.E. Anderson, A. Boesenberg, J. Harringa, D. Riegner, A. Steinmetz, and D. Hillman, "Comparison of Extensive Thermal Cycling Effects on Microstructure Development in Micro-alloyed Sn-Ag-Cu Solder Joints," JEM, (2012) 41, no. 2, pp. 390-397.
    c) Y.Q. Wu, W. Tang, M.J. Kramer, K.W. Dennis, N.T. Oster, R.W. McCallum, and I.E. Anderson, "Effective Grain Pinning Revealed by Nano-scale-electron Tomography," JAP, (2011) 109, no. 7, 3 pages, ID no. 235191JAP.
    d) W. Tang, Y.Q. Wu, K.W. Dennis, N.T. Oster, M.J. Kramer, I.E. Anderson, and R.W. McCallum, "Studies of Microstructure and Magnetic Properties in Sintered MRE-Fe-B Magnets (MRE=Nd+La+Dy)," JAP, (2011) 109, no. 7, 3 pages, ID no. 221191JAP
    e) I.E. Anderson, C. Meskers, and C.J. Jenks, "The Dawn of Materials Design and Processing for a Sustainable World," Int. Journal of Powder Metallurgy, 47, issue 1 (2011), pp. 17-22.
    f) I.E. Anderson, D. Byrd, and J.L Meyer, "Highly Tuned Gas Atomization for Controlled Preparation of Coarse Powder," MATWER, vol. 41, no. 7(2010), pp. 504-512.
    g) A.J. Heidloff, J.R. Rieken, I.E. Anderson, D. Byrd, J. Sears, M. Glynn, and R.M. Ward, "Advanced Gas Atomization Processing for Ti and Ti Alloy Powder Manufacturing," JOM, 62, No. 5 (2010), pp. 35-41.
    h) J. R. Rieken, I.E. Anderson, and M.J. Kramer, "Microstructure Evolution of Gas Atomized Iron Based ODS Alloys," Int. Journal of Powder Metallurgy, 46, issue 6 (2010), pp. 17-31.
    i) J. R. Rieken, I.E. Anderson, and M.J. Kramer, (Grand Prize: 2010 Excellence in Metallography Award) "Gas-Atomized Chemical Reservoir ODS Ferritic Stainless Steels," Int. Journal of Powder Metallurgy, 46, issue 6 (2010), pp. 9-12.

10. Briefly list the most recent professional development activities- None

Name
Scott P. Beckman

Education

Ph.D./M.S.	Material Science Engineering	U. of California at Berkeley	2005
B.S,	Ceramic Engineering	Iowa State University	1999

Appointments

Iowa State University	Assistant Professor	2008–present	full-time
Tohoku University	Visiting Associate Prof.	Summer 2011	full time
Rutgers University	Post-Doctoral Researcher	2007-2008	full time
U. of Texas at Austin	Post-Doctoral Researcher	2005-2007	full time
U. of California at Berkeley	Grad. Student Researcher	1999-2005	full-time

Society Memberships
Member of Material Research Society

Honors
Visiting Associate Professor at the Institute for Materials Research at Tohoku University in Sendai, Japan

Service Activities

- Organized the symposium, "Theoretical and Computational Studies of Defects in Crystals and the Mechanical Properties of Solids," at the 47th. annual technical meeting of the Society of Engineering Science in 2010.
- Organizer of the "Fundamental Physics of Ferroelectrics and Related Materials" conference to be held Spring 2013.
- Organizer of the symposium "New Materials for Solid-State Refrigeration" at the Spring 2013 MRS meeting.
- Faculty adviser to Iowa State University student chapter of the Material Research Society and to the ISU Quidditch Club
- Member of MRS Academic Affairs Committee and Student Chapter Sub-Committee.
- Member of MSE Graduate Studies Committee (2008-present)
- Chair MSE Seminar Committee (2011-present)
- Member of University RPPC Committee,

Select List of Recent Publications

- *Predicting the Electrocaloric Behavior of $BaTiO_3$*" in review at Appl. Phys. Lett. February 2012.
- C. Ma, H. Guo, S. P. Beckman, and X. Tan "*Morphotropic phase boundaries for piezoelectricity: Make it or break it*" submitted February 2012.
- C. Bishoff, K. Schuller, S. P. Beckman and S. W. Martin "*Non-Arrhenius ionic conductivities in glasses due to a distribution of activation energies*" in review at Phys. Rev. Lett. December 2011.
- L. F. Wan, T. Nishimatsu, and S. P. Beckman. "*The structural, dielectric, elastic, and piezoelectric properties of $KNbO_3$ from first-principles methods*" in review at J. Appl. Phys. November 2011.
- L. F. Wan and S. P. Beckman "*Chemical doping the XYB_{14} complex borides*" Mater. Lett. **74**, 5-7 (2012).
- K. Bayus, O. Paz, and S. P. Beckman "*The structure, energy, and electronic states of vacancies in Ge nanocrystals*" Phys. Rev. B **82**, 155409 (2010).
- S. P. Beckman, W. Wang, K. M. Rabe and D. Vanderbilt "*Ideal barriers to polarization reversal and domain-wall motion in strained ferroelectric thin films*" Phys. Rev. B **79**, 144124 (2009).
- T. Zayak, S. P. Beckman, M. L. Tiago, P. Entel, and J. R. Chelikowsky, "*Switchable Ni-Mn-Ga Heusler nanocrystals*" J. Appl. Phys. **104**, 074307 (2008).
- Natan, A. Benjamini, D. Naveh, L. Kronik, M. L. Tiago, S. P. Beckman, and J. R. Chelikowsky. "*Real-space pseudopotential method for first principles calculations of general periodic and partially periodic systems*" Phys. Rev. B. **78**, 075109 (2008).

Most Recent Professional Development Activities

- Attended "NSF Day" at University of Iowa in 2009
- Attended ISU ADVANCE workshop on best practices in hiring 2009
- Attended International Congress for Ceramics in Osaka, Japan, in as an NSF Delegate in 2010
- Held the appointment Visiting Associate Professor at the Institute for Materials Research at Tohoku University in Sendai, Japan 2011
- Underwent a teaching evaluation by ISU Center for Education Learning and Teaching in 2012
- I have been accepted as a participate at the International Conference of Young Researchers on Advanced Materials in Singapore July 2012

1. **Name**

Nicola Bowler, Associate Professor

2. **Education**

B.S., Physics, University of Nottingham, UK, 1990
Ph.D., Physics, University of Surrey, UK, 1994

3. **Academic Experience**

- Iowa State University, Ames IA, Associate Professor, August 2006-Present
- Iowa State University, Ames IA, Adjunct Associate Professor, August 2001-August 2006

4. **Non-Academic Experience**

Defence Evaluation Research Agency, Senior Scientist, 1999

5. **Certifications or Professional Registrations:**

None

. **Current Membership in Professional Organizations**

- American Society for Nondestructive Evaluation, Member since 2005.
- Institute of Electrical and Electronic Engineers, Senior Member since 2002.
- National Academy of Electromagnetics, Member since 2000.
- Institute of Physics, Member since 1995.

7. **Honors and Awards**

- Akinc Excellence in Teaching Award, April 2011.
- "Topical Review: Four-Point Potential Drop Measurements for Materials Characterization" featured on the cover of Measurement Science and Technology, 2011.
- Outstanding Mentor Award, US Department of Energy, February 2006.
- 2005 Measurement Science and Technology Outstanding Paper Award.

8. **Service Activities (within and outside of the institution)**

- Senior Associate Editor for IEEE Transactions on Dielectrics and Electrical Insulation, Associate Editor for Measurement Science and Technology, Technical Editor for Journal of Nondestructive Evaluation
- Reviewer for 20 archival journals and 6 international conferences
- Secretary of the CEIDP Board, 2010 – 2012
- Session Organizer and Chairperson, Review of Progress in Quantitative Nondestructive Evaluation (QNDE) 2010 and 2005
- Technical Program Committee Member, CEIDP 2009
- Conference Proceedings Co-Editor, 14th International Workshop on Electromagnetic Nondestructive Evaluation (ENDE) 2009
- Session Organizer and Chairperson, ENDE 2009
- Technical Committee Member, ENDE 2009
- Faculty Senator and College of Engineering Caucus member, from August 2011.
- Center for Nondestructive Evaluation Leadership Group, from February 2011.
- Materials Science and Engineering Department Faculty Search Committee Member, 2010 – 2011.
- Vice President for Research and Economic Development Review Team Member, reviewing Institute for Transportation (InTrans), 2010.

- Materials Science and Engineering Department Strategic Planning Committee Member, 2008 – 2010.

9. **Significant Publications/Presentations from the past five years**

1. T. Chen and **N. Bowler**, Analysis of a Capacitive Sensor for the Evaluation of Circular Cylinders with a Conductive Core, *Meas. Sci. Technol.*, 23, 045102 (10pp), 2012.
2. Y. Li and **N. Bowler**, Analysis of Double-Negative (DNG) Bandwidths for Metamaterials Composed of Three-Dimensional Periodic Arrays of Two Different Magnetodielectric Spheres Arbitrarily Arranged on a Simple Tetragonal Lattice, *IEEE Antennas and Wireless Propagation Letters*, 10, 1484-1487, 2011.
3. J. Liu and **N. Bowler**, Analysis of Double-Negative (DNG) Bandwidth for a Metamaterial Composed of Magnetodielectric Spheres Embedded in a Matrix, *IEEE Antennas and Wireless Propagation Letters*, 10, 399-402, 2011.
4. **N. Bowler**, Topical Review: Four-Point Potential Drop Measurements for Materials Characterization, *Meas. Sci. Technol.*, 22, 012001 (11pp), 2011.
5. Y. Li, **N. Bowler** and D. B. Johnson, A Resonant Microwave Patch Sensor for Detection of Layer Thickness or Permittivity Variations in Multilayered Dielectric Structures, *IEEE Sensors J.*, 11, 5-15, 2011. DOI: 10.1109/JSEN.2010.2051223
6. T. Chen and **N. Bowler**, Analysis of a Concentric Coplanar Capacitive Sensor for Nondestructive Evaluation of Multi-layered Dielectric Structures, *IEEE Trans. Dielectr. Electr. Insul.*, 17, 1307-1318, 2010.
7. L. Li, **N. Bowler**, M. R. Kessler and S.-H. Yoon, Dielectric Response of PTFE and ETFE Wiring Insulation to Thermal Exposure, *IEEE Trans. Dielectr. Electr. Insul.*, 17, 1234-1241, 2010.
8. Y. Li and **N. Bowler**, Resonant Frequency of a Rectangular Patch Sensor Covered With Multilayered Dielectric Structures, *IEEE Trans. Ant. Propag.*, 58, 1883-1889, 2010.
9. C. Zhang, **N. Bowler** and C. C. H. Lo, Magnetic Characterization of Surface-Hardened Steel, *J. Magnetism and Magnetic Materials*, 321, 3878-3887, 2009.
10. J. R. Bowler and **N. Bowler**, Theory of Four-Point Alternating Current Potential Drop Measurements on Conductive Plates, *Proc. R. Soc. A*, 463, 817-836, 2007.

10. **Most Recent Professional Development Activities**

1. USNC-USRI National Radio Science Meeting, Boulder, CO, January 4-6, 2012.
2. Conf. on Electrical Insulation and Dielectric Phenomena, Cancun, Mexico, 2011.
3. 12th Int. Symp. on Nondestructive Char. of Materials, Blacksburg, VA, 2011.
4. The 2011 Aircraft Airworthiness and Sustainment Conference, San Diego, CA,2011.
5. Dielectrics 2011, Canterbury, United Kingdom, 2011.

1. Name: Kaitlin Bratlie

2. Education – University of California, Berkeley, Ph.D. Chemistry December 2007
   University of Minnesota, Institute of Technology, B.S. Chemistry May 2003

3. Academic experience –
   2011-present Assistant Professor, Iowa State University
   2008-2011 Postdoctoral Research Fellow, MIT
   2003-2007 Graduate Research Fellow, University of California, Berkeley

4. Non-academic experience-non

5. Certifications or professional registrations-none

6. Current membership in professional organizations-MRS, member- AIChE, member

7. Honors and awards
   NIH postdoctoral fellow 2010
   Dorothy M. & Earl S. Hoffman Travel Grant 2006 and 2007
   University of California, Berkeley Conference Travel Grant 2006
   Undergraduate Research Opportunities Program Grant 2001
   Hamline Honors Scholarship Recipient 1999
   Dean's List 1999

8. Service activities (within and outside of the institution)
   Reviewer for Langmuir
   Reviewer for Journal of Thermal Analysis and Calorimetry
   Reviewer for DOE Office of Science Graduate Fellowship Program
   Graduate Studies Committee member, MSE
   Bioengineering Committee member, ISU
   New Meetings Subcommittee, MRS

9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

   a. K.M. Bratlie, R.L. York, M.A. Invernale, R. Langer, D.G. Anderson. "Materials for diabetes therapeutics," *Advanced Healthcare Materials* 2012, *in press.*
   b. M. Ma, W.F. Liu, P. S. Hill, K.M. Bratlie, D.J. Siegwart, J. Chin, M. Park, J. Guerreiro, D.G. Anderson. "Development of cationic polymer coatings to regulate foreign-body response," *Adv Mater.* 2011, 23, H189. Cover article.

c. W.F. Liu, M. Ma, K.M. Bratlie, T.T. Dang, R. Langer, D.G. Anderson. "Real-time in vivo detection of biomaterial-induced reactive oxygen species," *Biomaterials* 2011, 32, 1796.
d. Tram T. Dang, Kaitlin M. Bratlie, Said R. Bogatyrev, Xiao Chen, Robert S. Langer,Daniel G. Anderson. "Spatio temporal effects of a controlled-release anti-inflammatory drug on the cellular dynamics of host response," *Biomaterials* 2011,
e. R.L. York, K.M. Bratlie, L.R. Hile, L.K. Jang. "Dead zones in porous catalysts: concentration profiles and efficiency factors," *Catal. Today* 2011, 160, 204.
f. K.M. Bratlie, T.T. Dang, S. Lyle, M. Nahrendorf, R. Weissleder, R. Langer, D.G. Anderson. "Rapid biocompatibility analysis of materials via in vivo fluorescence imaging of mouse models," *PLoS ONE* 2010, 5, e10032.
g. T.T. Dang, Q. Xu, K.M. Bratlie, I. Chen, R. Langer, D.G. Anderson. "Convenient mass production of cell-laden hydrogel microcapsules using thermo-molded polypropylene mesh," *Biomaterials* 2009, 30, 6896.
h. M.E. Grass, Y. Zhang, D. Butcher, J.Y. Park, Y. Li, H. Bluhm, K.M. Bratlie, T. Zhang, G.A. Somorjai. "Reactive oxide over layer on Rh nanoparticles during CO oxidation and its size dependence studied by in situ ambient pressure XPS," *Angew. Chem. Int. Edit.* 2008, 47, 8893.
i. K.M. Bratlie, K. Komvopoulos, G.A. Somorjai. "Sum frequency generation vibrational spectroscopy of pyridine hydrogenation on platinum nanoparticles," *J. Phys. Chem. C* 2008, 112, 11865
j. K.M. Bratlie, Y. Li, R. Larsson, G.A. Somorjai. "Compensation effect of benzene hydrogenation on Pt(111) and Pt(100) analyzed by the selective energy transfer model," Catal. *Let.* 2008, 121, 173
k. K.M. Bratlie, H. Lee, K. Komvopoulos, P. Yang, G.A. Somorjai. "Platinum nanoparticle shape effects on benzene hydrogenation selectivity," *Nano Letters* 2007, 7, 3097
l. K.M. Bratlie, G.A. Somorjai. "A sum frequency generation vibrational spectroscopic study of the adsorption and reactions of C6 hydrocarbons at high pressures on Pt(100)," *J. Phys. Chem. C* 2007,111, 6837.
m. A.M. Contreras, M. Montano, S.J. Kweskin M.M. Koebel K. Bratlie, K. Becraft, G.A. Somorjai."Molecular surface science of C-H bond activation and polymerization catalysis," *Top. Catal.* 2006, 40, 19.
n. G.A. Somorjai, K.M. Bratlie, M.O. Montano, J.Y. Park. "Dynamics of surface catalyzed reactions: the roles of surface defects, surface diffusion, and hot electrons," *J. Phys. Chem. B* 2006,110, 20014.

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10. Briefly list the most recent professional development activities-
- Fundamentals of Grant Writing Seminar," Sept. 19, 2011
- "Writing a Compelling Grant Proposal to NSF," Sept. 20, 2011
- "Faculty Mentoring Program," Nov. 16, 2011
- "NSF Workshop 1," at AIChE conference, Oct. 17, 2011

1. Name: Ludovico Cademartiri

2. Education- Laurea Magistrale, Materials Science, University of Parma, 2002
PhD, Interdisciplinary Chemistry, University of Toronto, 2008

3. Academic experience (all full time)-

2012	Iowa State University, Assistant Professor
2009-2011	Harvard University, NSERC Postdoctoral Fellow
2008-2009	Harvard University, Postdoctoral Fellow

4. Non-academic experience – none

5. Certifications or professional registrations-none

6. Current membership in professional organizations- ACS, AICHE

7. Honors and awards

Natural Sciences and Engineering Research Council of Canada Postdoctoral Fellowship	2009
IUPAC Prize for Young Chemists – Honorable Mention	2009
Canadian Society of Chemistry Chemistry Doctoral Award	2009
Governor General's Gold Medal	2008
American Chemical Society DIC Young Investigator Award	2008
Canadian Society of Chemistry Prize for Graduate Work in Inorganic Chemistry	2008
Materials Research Society Graduate Student Award – Silver Medal	2006
Materials Research Society Graduate Student Award – Silver Medal	2005

8. Service activities (within and outside of the institution)
Referee for Langmuir, Optics Communications, the Journal of the American Chemical Society, Sensors and Actuators, Optics Letters, ACS Applied Materials & Interfaces, Nanoscale, Philosophical Transactions of the Royal Society A, NanoToday, Polymer, Small, Angewandte Chemie, European Journal of Inorganic Chemistry, ACS Nano, Carbon, Journal of Thermal Analysis and Calorimetry, ChemPlusChem, Journal of Intelligent Material Systems and Structures

9. Briefly list the most important publications and presentations from the past five years Large Scale Synthesis of Ultrathin Bi_2S_3 Necklace Nanowires
*<u>L. Cademartiri</u>, R. Malakooti, P. G. O'Brien, A. Migliori, S. Petrov, N. P. Kherani, G. A. Ozin**
Angewandte Chemie International Edition 2008, 20, 3814-3817

Crosslinking Bi_2S_3 Ultrathin Nanowires: A Platform for Nanostructure Formation and Biomolecule Detection
<u>L. Cademartiri</u>, F. Scotognella, P. G. O'Brien, B. V. Lotsch, J. Thomson, N. P.

*Kherani, G. A. Ozin**
Nano Letters 2009, 9(4), 1482-1486

On the Nature and Importance of the Transition between Molecules and Nanocrystals: Towards a Chemistry of "Nanoscale Perfection"
L. Cademartiri, V. Kitaev**
Nanoscale 2011, 3, 3435

Plasma within Templates: Molding Flexible Nanocrystal Solids into Multifunctional Architectures
*A. Ghadimi, L. Cademartiri, U. Kamp, G. A. Ozin**
Nano Letters 2007, 7(12), 3864-3868

Crystalline Nanowires with the Growth and Form of Polymer Molecules
L. Cademartiri, G. Guerin, K. J. M. Bishop, M. A. Winnik, G. A. Ozin**
Journal of the American Chemical Society 2012, in press

10. Briefly list the most recent professional development activities

1. REBECCA CADEMARTIRI

2. Education

2002 University Diploma, Organic Chemistry, Johannes Gutenberg University, Germany

2005 Ph.D., Physical Chemistry, University of Potsdam, Max Planck Institute of Colloids and Interfaces, Germany / University of Toronto, Canada

3. Academic Experience

2012- Adjunct Assistant Professor, Department of Chemical and Biological Engineering and Department of Materials Science and Engineering, Iowa State University

4. Non-academic Experience

2009-2011 Postdoc, Harvard University

2008-2009 Postdoc, Tufts University

2005-2008 Postdoc, McMaster University

2005 Visiting Researcher, Merck AG Darmstadt, Germany

5. Certifications or Professional Registrations

6. Membership in Professional Organizations

7. Honors and Awards

8. Service Activities

9. Publications

M. Egen, R. Voss, B. Griesebock, R. Zentel, S. Romanov, and C. S. Torres, "Heterostructures of Polymer Photonic Crystal Films," *Chemistry of Materials*, **15**(20), 2786-3792 (2003).

R. Voss, A. Thomas, M. Antonietti, and G. A. Ozin, "Synthesis and Characterization of a Highly Amine Functionalized Mesoporous Organosilicas by an 'All-In-One' Approach," *Journal of Materials Chemistry*, **15**(37), 4010-4014 (2005).

A. Ide, R. Voss, G. Scholz, G. A. Ozin, M. Antonietti, and A. Thomas, "Organosilicas with Chiral Bridges and Self-generating Mesoporosity," *Chemistry of Materials*, **19**(10), 2649-2657 (2007).

R. Voss, M. A. Brook, J. Thompson, Y. Chen, R. H. Pelton, and J. D. Brennan, "Non-Destructive Horseradish Peroxidase Immobilization in Porous Silica Nanoparticles," *Journal of Materials Chemistry*, **17**(46), 4854-4863 (2007).

R. Cademartiri, M. A. Brook, R. H. Pelton, and J. D. Brennan, "Macroporous Silica Using a 'Sticky'' Stöber Process," *Journal of Materials Chemistry*, **19**(11), 1583-1592 (2009).

R. Cademartiri, H. Anany, I. Gross, R. Bhayani, M. Griffiths, and M. A. Brook, "Immobilization of Bacteriophages on Modified Silica Particles," *Biomaterials*,

31(7), 1904-1910 (2010).

S. Vella, P. Beattie, R. Cademartiri, A. Laromaine, A. W. Martinez, S. T. Phillips, K. A. Mirica, and G. M. Whitesides, "Measuring Markers of Liver Function Using a Micropatterned Paper Device for Blood from a Fingerprick," *Analytical Chemistry*, **84**(6), 2883-2891 (2012).

Presentations

M. A. Brook, R. Voss, J. Thomson, Y. Chen, R. H. Pelton, J. D. Brennan, " Preparation of Silica Particles under Biocompatible Conditions and Their Use for Detection" *ACS,* Boston, (2007).

R. Voss, M. A. Brook, "Bacteria Seeing Red: Isolation and Detection of Bacteria in Resource Poor Settings Using Silica, Paper and Bacteriophages" *CCS,* Edmonton, (2008).

10. Professional Development Activities

1. Name: Scott L. Chumbley

2. Education – Ph.D., Metallurgical Engineering University of Illinois, Urbana1986
   B.S., Metallurgical Engineering University of Illinois, Urbana 1981

3. Academic experience –

2001 – present	Professor at Iowa State University
1993 -2001	Associate Professor at Iowa State University
1987-1993	Assistant Professor at Iowa State University
1983	Teaching Assistant, University of Illinois, Urbana. Served as a laboratory teaching assistant for a workshop on convergent beam electron diffraction

4. Non-academic experience –

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2009	Visiting Research Professor, University of Pittsburgh
2001	Materials Engineer, Perkins Engines, Peterborough, England
1993-present	Scientist, Ames Laboratory, DOE, ISU
1987-1993	Associate Metallurgist, Ames Laboratory, DOE, ISU
1986-1987	Postdoctoral Research Assistant, Argonne National Laboratory
1981 -1986	Research Assistant, University of Illinois, Urbana.

5. Certifications or professional registrations-

6. Current membership in professional organizations-
   ASM International, The Metallurgical Society, American Ceramic Society, Association of Iron and Steel Technology

7. Honors and awards
   Edmond J. James Scholar
   Alpha Sigma Mu Metallurgical Honor Society
   ARCO Fellowship
   MSE Department Outstanding Teacher, 2002-2003
   MSE Department Outstanding Professor, E-week Festivities, 2003
   ISU Engineering Student Council Leadership Award, 2006, 2008
   ISU Superior Engineering Teacher Award, 2009
   Fellow, ASM International, 2011

8. Service activities (within and outside of the institution)
   Reviewer for The Physical Review, Journal of Applied Physics, Physica C*
   Metallurgical Transactions, National Science Foundation, Department of Energy
   National Academy of Science advisory committee on establishing a national ballistics database. 2004-06

9. The most important publications and presentations from the past five years

a. Ş. Ozlem Turhan, B.Yagmurlu*, L.S. Chumbley, Y.E. Kalay, "Microstructural Investigation of Superaustenitic Stainless Steels," 20th National Electron Microscopy Congress, Ankara, Turkey, October 24-28, 2011.
b. L. Ekstrand, S. Zhang, L.S. Chumbley, T. Grieve*, V. Villagomez, D.J. Eisenmann, M. Morris, J. Kreiser, "Virtual Tool Mark Characterization," 39th annual ASCLD meeting, Denver, Sep. 18-22, 2011.
c. T. Grieve, L.S. Chumbley, B. King, D. Eisenmann, "Clarity of Microstamped Identifiers as a Function of Primer Hardness and Firearm Action," 39th annual ASCLD meeting, Denver, Sep. 18-22, 2011.
d. T. Grieve, L.S. Chumbley, B. King, D. Eisenmann, "Clarity of Microstamped Identifiers as a Function of Primer Hardness and Firearm Action," MFRC Annual meeting, St. Louis, May 24-26, 2011.
e. S. Zhang, L. S. Chumbley, M. Morris, B. King, T. Grieve, A. Hoeksema, Y. Gong, V. Villagomez, D. J. Eisenmann, J. Kreiser; "Manipulative Virtual Tools for Toolmark Characterization," AFTE training conference, Chicago, May 29-June 3, May 2011.
f. S. Chumbley, A. Russell, A. Becker, "Testing and Recommended Practices
to Improve Nurse Tank Safety," invited presentation, Ag-Coop Safety Director of Iowa meeting, in cooperation with the Iowa Depart. of Ag. And Land Services, Nevada, IA, March 8, 2011.
g. S. Chumbley, A. Russell, A. Becker, "Testing and Recommended Practices
to Improve Nurse Tank Safety," invited presentation, Nurse Tank Testing workshop, Agribusiness Association of Iowa in cooperation with US Dep. Of Trans. and the Iowa Depart. Ag. and Land Services, Nevada, IA, Dec. 7, 2010.
h. B. King, S. Chumbley, "TTT determination in Superaustenitic Steel using Charpy Impact Testing," invited presentation, Technical and Operating Conference, Steel Founders Society of America, Chicago, IL, Dec 12-15, 2010
i. L.S. Chumbley, D. J. Eisenmann, M. Morris, S. Zhang, J. Kreiser, C. Fisher, J. Kraft, D. Faden, "Quantification of Toolmarks", Pattern and Impression Evidence Symposium, Clearwater Beach, FL, August, 2010.
j. L.S. Chumbley, "Fracture Toughness in Superaustentic CN3MN," invited presentation, High Alloy Research Committee, Steel Founders Society of America, Dayton, OH, Aug. 26, 2009.
k. L.S. Chumbley, D.J. Eisenmann, M. Morris, S. Zhang, J. Craft, C. Fisher and A. Saxton, "Use of a Scanning Optical Profilometer for Toolmark Characterization", invited presentation, Scanning '09, Monterrey, CA, April, 2009

10. Briefly list the most recent professional development activities-

1. Alan Constant

2. Ph.D. Materials Science & Engineering, Northwestern Univ., Evanston, IL (1987)
   B.S. Materials Science & Engineering, Cornell Univ., Ithaca, NY (1981)

3. ***Senior Lecturer***, Materials Science & Engineering, Iowa State Univ. (May 2010 – Present)
   Lecturer, Materials Science & Engineering, Iowa State Univ. (May 2005 – May 2010)
   Assistant Professor, Materials Science & Engineering, Iowa State Univ. (Jan. 2002 – May 2005)
   Assistant Professor, Materials Science & Engineering, Iowa State Univ. (Jan. 1998 – Jun. 2001)
   Post-Doc, Materials Science and Engineering Department, Northwestern Univ., Evanston IL (Jun. 1987 – Mar. 1988)
   Graduate Assistant, Materials Science and Engineering Department, Northwestern Univ. (Sep. 1981 – Jun. 1987)

4. ***Senior Engineer***, Micron Technologies, Boise Idaho (Jul. 2001 – Jan. 2002)
   Associate Scientist, Materials Research Center, Institute for Physical Research & Technology, Iowa State Univ. (Jun. 1992 – Jan. 1998)
   Senior Process Development Engineer, Advanced Semiconductor Development Group, Digital Equipment Corporation, Hudson, MA (Jun. 1988 – Feb. 1992)

5. None
6. None

7. Ames Laboratory Inventor Incentive Award (2009)
   Ames Laboratory Inventor Incentive Award (2008)
   Nominated by students for The National Society of Collegiate Scholars "Inspire Integrity Award" (2008)
   Superior Teaching Award, College of Engineering, Iowa State Univ. (2007)
   MSE Excellence in Teaching Award, Iowa State Univ. (2006)
   Process Development Award, Digital Equipment Corp. (1992)
   IBM Fellowship Award (1984-1985)
   3M Fellowship Award (1983-1984)
   NY Regents State Scholarship (1977-1981)

8. Undergraduate Curriculum Committee, Materials special topics discussion group, Vice President & Board Member Ames Soccer Club

9. Herman D.M., Cao G., Becker A.T., Russell A.M., and Constant A.P., "Microstructure and properties of a silver-erbium oxide alloy", Journal of Alloys and Compounds, Vol. 454, pp. 292-296 (2008).

10. None

1. Name: Kristen P. Constant

2. Education – degree, discipline, institution, year

1986 B.S. Ceramic Engineering, Iowa State University
1990 Ph.D. Materials Science and Engineering, Northwestern University

3. Academic experience –

3/92 - 6/98 Asst. Professor, MSE, ISU
7/98 - 7/01 Assoc. Prof., Assistant Chair of Undergraduate Programs, MSE ISU
1/02 – 6/11 Assoc.Professor, MSE, ISU
6/04 - 8/05 Administrative Intern, ½ time, Office of the Provost, ISU
1/07 - 7/09 ADVANCE Professor, MSE (ISU NSF-ADVANCE program), ¼ time
7/09 – pres. COE ADVANCE Equity Advisor. 1/3 time
7/11- pres. Professor, Materials Science & Engineering, ISU, Ames, IA

4. Non-academic experience

7/01-1/02 Engineer, Micron Technologies, Boise Idaho. Full time
5-8/86 Engineering Intern, IBM, East Fishkill, NY
5-8/84 Engineering Intern, Brush Wellman Engineered Ceramics, Tucson, AZ
5-8/83 Engineering Intern, Honeywell Solid State Electronics, Plymouth, MN.

5. Certifications or professional registrations: none
6. Current membership in professional organizations:
   ASEE, WEPAN, TMS
7. Honors and awards
   Women Impacting ISU Recipient, 2008
   Nominated by Interfraternity Council for Professor of the Year, 2007
   WELI (Women in Engineering Leadership Institute) Selected Participant 2005
   MSE Excellence in Teaching Award, April 2004
   SLIC (Shared Leadership for Institutional Change) Selected Participant 2000

8. Service activities (within and outside of the institution)

EXTERNAL:

Reviewer: Journal of Applied Physics, Applied Physics Letters, Journal of the American Ceramic Society, Various Panel Reviews, Textbook reviews for Wiley, Springer and McGraw Hill, Journal of Women in Science and Engineering. Program Chair of WIED (Women in Engineering Division) of ASEE.

INTERNAL

MSE Curriculum committee, ISU Administrative Fellow for Strategic Planning 2004-2005, significant efforts in outreach for recruiting and retaining women and underrepresented minority students, including WiSE, SWE, Science Bound. Chair of University Committee on Women, Member of Women Leadership Consortium, Faculty Senate Women and Minorities Committee Chair, Developed and Executed Search Committee Training for over 20 search committees in the college and university, Faculty Peer Mentor Coordinator, Past: Honors program chair, co-op/internship program chair, and over 50 thesis and dissertation committees

9. Briefly list the most important publications and presentations from the past five years –

   J.-M. Park, T.-G. Kim, K. Constant, K.-M. Ho, "Fabrication of submicron metallic grids with interference and phase-mask holography", J. Micro/Nanolith. MEMS 10(1) (2011)

   P. Kuang, J.-M. Park, W. Leung, R.C. Mahadevapuram, K.S. Nalwa, T.-G Kim, S. Chaudhary, K.-M. Ho, K. Constant, "A new architecture for transparent electrodes: Relieving the trade-off between electrical conductivity and optical transmittance", Adv. Mater. 2011, 23, 2469-2473

   Joong-Mok Park, Zhengqing Gan, Wai Y. Leung, Rui Liu, Zhuo Ye, Kristen Constant, Joseph Shinar, Ruth Shinar, and Kai-Ming Ho, "Soft holographic interference lithography microlens for enhanced organic light emitting diode light extraction," Optics Express Vol. 19, Iss. S4, pp. A786–A792 (2011)

   P. Kuang, J.-H. Lee, C.-H. Kim, K.-M. Ho, K. Constant, Improved surface wettability of polyurethane films by Ultraviolet Ozone treatment, Journal of Applied Polymer Science, 118 (5), 3024-3033, (2010)

   J. M. Park, K. S. Nalwa, W. Leung, K. Constant, S. Chaudhary and K. M. Ho "Fabrication of metallic nanowires and nanoribbons using laser interference lithography and shadow lithography" Nanotechnology, 21 (21) (2010)

   K.P. Constant, "ISU ADVANCE – Sustaining and Institutionalizing Efforts to Enhance Recruitment, Retention and Advancement of Women Faculty in Engineering" Proceedings of the ASEE Annual Conference (2011)

   K.P. Constant, "ISU ADVANCE – Transformation Across the University Hierarchy to Enhance Recruitment, Retention and Advancement of Women Faculty in Engineering", Proceedings of the ASEE Annual Conference (2010)

10. Briefly list the most recent professional development activities
   WLRG (Women's Leadership Reading Group) (2005-present)
   Provost internship 2004-2005
   ADVANCE fellow, Summer 2010

1. Name: Lawrence J. Genalo

2. Education – Ph D., Iowa State University, Applied Math – emphasis in Systems Engineering (unofficial), 1977

3. Academic experience – (all full time except graduate TA position)

2009-present	University Professor, Iowa State University
2000-2009	Professor, Iowa State University
2001- present	Associate Chair for Undergraduate Education & Admin
1982-2000	Associate Professor, Iowa State University,
1977-1982	Assistant Professor, Iowa State University
1976-1977	Visiting Assistant Professor, Iowa State University
1973-1976	Instructor, Iowa State University
1971-1973	*Halftime* Graduate Teaching Assistant, Iowa State U

4. Non-academic experience: (all full time)

1979	Reliability Engineer, Sundstrand HT Corp., Ames, IA
1978	Reliability Engineer, Sundstrand HT Corp., Ames, IA
1977	Reliability Engineer, Sundstrand HT Corp., Ames, IA

Summer positions working on statistical reliability of hydrostatic transmissions

1971	Actuarial Trainee, Royal Globe Insurance, New York, NY

Statistical work in insurance

1969	Electronics Technician, Hazeltine Electronics, Greenlawn, NY
1968-1969	Electronics Technician, Hazeltine Electronics, Greenlawn, NY

Electronics work, outgrowth of USAF work

1965-1968	Radar/Computer Technician, USAF

5. Certifications or professional registrations: none

6. Current membership in professional organizations: ASEE

7. Honors and awards

Fellow of ASEE, 2012
University Professor, 2009
PWSE first 20 years "Champion Award," April, 2007 at 20 year anniversary dinner
Educator of the Year (for the State of Iowa preK-univ), Technology Association of Iowa, 2006
Selected for inclusion in the AcademicKeys Who's Who in Sciences Higher Education, 2004
NASA Certificate of Appreciation, 2002
Engineering Student Council Leadership Award, 2002

ISU Award for Excellence in Honors Teaching, 2001
Student Affairs Faculty Appreciation Award, 2001
Engineering Student Council Professor of the Year, 2001
LEAD Program Special Recognition Award, 2000
LEAD Program Faculty Involvement Award, 1999
LEAD Program Special Recognition Award, 1998
State of Iowa Regents Faculty Excellence Award, 1996
Miller Faculty Fellow, 1996
ISU Foundation Career Achievement in Teaching, 1995
ASEE Centennial Certificate, 1993
AMOCO Foundation Award for Outstanding Teaching, 1993
Excellence in Teaching, State of Iowa, 1989-90
Superior Engineering Teacher, College of Engineering, 1989
Oppenheimer Award, ASEE Midyear, EDGD, 1985
Thielman Award, Iowa State University, 1974
American Math Society, 1973
Magna Cum Laude, Hofstra University, 1971
Kappa Mu Epsilon, 1970
Sigma Kappa Alpha, 1970

8. Service activities (within and outside of the institution)

Chair, ASEE/NSF Grantees' Poster Division, 2009-present; Associate Editor for Materials Education, Engineering Pathways Project, 2007- present; Member of the editorial board of IJEE (2006-present); Center for Technology in Learning and Teaching Advisory Board member, 2005-present; The Science Center of Iowa Science Advisory Board, Member 2003-present, Invited chair for Experiential Learning, one of four sections of the NSF Workshop on Restructuring Engineering Education, Washington, D.C., June 6-9, 1994; Chair, ASEE/DELOS, 1991-92; Chairman, Freshman Programs Constituent Committee (ASEE), 1988-1989;

9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

a. Tan, K.K., Genalo, L.J., Verner, I., IEEE Transaction on Education, Special Issue on Outreach in Electrical Engineering, Vol 53, issue 1, Feb, 2010.
b. Tan, K.K., Genalo, L.J., Verner, I., The International Journal of Engineering Education, Special Issue on Outreach in Engineering Education, Vol 25-3, 2009.
c. L.S. Chumbley, J. Kreiser, C. Fisher*, J. Craft*, M. Morris, L. Genalo, S. Davis*, D. Faden*, J. Kidd*, "Validation of Toolmark Comparisons Obtained Using a Quantitative, Comparative, Statistical Algorithm," Journal of Forensic Science, Vol 55, issue, p 953-961, July, 2010.
d. Filming of Materials demonstrations for ASM, national distribution (in 2009) by ASM. Encore Video, Inc. produced the video, 2008.

10. Briefly list the most recent professional development activities- workshops on writing NSF engineering education proposals, presenter

1. Karl A. Gschneidner

2. Education –
   B.S., Chemistry, University of Detroit, 1952
   Ph.D., Physical Chemistry, Iowa State University, 1957

3. Academic experience –
   1979-present – Anson Marston Distinguished Professor, Department of Materials Science and Engineering, Iowa State University, (Associate Professor 1963-1967; Professor 1967-1979)
   1979-1980 – Visiting Professor, University of California, San Diego
   1962-1963 – Visiting Assistant Professor, Department of Physics, University of Illinois, Urbana

4. Non-academic experience –
   Ames Laboratory, Iowa State University, Senior Metallurgist, 1967-present (Metallurgist 1963-1967)
   Institute for Physical Research and Technology, Iowa State University, Director, Rare-earth Information Center, 1966-1996
   Los Alamos National Laboratory, Los Alamos, NM, Staff Member (Section Leader 1961-1963), 1957-1963

5. Certifications or professional registrations – None

6. Current membership in professional organizations
   The Minerals, Metals, and Materials Society; ASM (American Society of Materials) International; American Crystallographic Association; American Physical Society; American Chemical Society; Materials Research Society; IEEE-Magnetics Society; Society of Sigma Xi; AAAS; Iowa Academy of Sciences; National Academy of Engineering

7. Honors and awards (*selected*)
   Hume-Rothery Award, The Minerals, Metals and Materials Society, 1978
   Distinguished Professor, Iowa State University, 1979
   Burlington Northern Award for Excellence in Research, Iowa State University, 1989
   Fellow, The Minerals, Metals and Materials Society, 1990
   Fellow, ASM International, 1990
   Frank H. Spedding Award, Rare Earth Research Conferences, Inc., 1991
   Honorary Member Materials Research Society of India, 1993
   David R. Boylan Eminent Faculty Award in Research, College of Engineering, Iowa State University, 1997
   Department of Energy's 1997 Materials Sciences Research Competition in the Significant Implication for Department of Energy Related Technologies in Metallurgy and Ceramics Category, 1997
   US DOE's Energy100 Award for the "Magnetic Refrigeration Unit", January

2001
Science Alumnus of the Year 2000, University of Detroit Mercy
Honorary Member The Japan Institute of Metals, 2001
Fellow, American Physical Society, 2002
Excellence in Research Award, Department of Materials Science and Engineering, Iowa State University, April 2006
Elected to National Academy of Engineering, 2007
Acta Materialia Gold Medal, 2008
Fellow, American Association for the Advancement of Science, 2010
Fellow, Materials Research Society, 2011

8. Service activities (within and outside of the institution)
   Testified before the U.S. House of Representatives' Science and Technology Committee on the rare earth crisis, in March 2010 and December 2011.
   Also gave seminars and talks on the rare earth crisis for several (14) professional societies and governmental panels.
   Member of the Board of Governors of the Rare Earth Research Conference

9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation
   "Giant Magnetocaloric Effect in $Gd_5(Si_2Ge_2)$", V. K. Pecharsky and K. A. Gschneidner, Jr., Phys. Rev. Lett. **78**, 4494-4497 (1997). *[Cited 1255 times as of November 2011]*
   "Recent Developments in Magnetocaloric Materials",K.A. Gschneidner, Jr., V.K. Pecharsky and A.O. Tsokol, Rept. Prog. Phys. **68** 1479-1539 (2005). *[Cited 605 times as of November 2011]*
   "Thirty Years of Near Room Temperature Magnetic Cooling: Where We Are Today and Future Prospects", K.A. Gschneidner, Jr. and V.K. Pecharsky, Int. J. Refrig. **31**, 945-961 (2008).
   "A Family Of Ductile Intermetallic Compounds", K. A. Gschneidner, Jr., A. Russell, A. Pecharsky, J. Morris, Z. Zhang, T. Lograsso, D. Hsu, C. H. C. Lo, Y. Ye, A. Slager and D. Kesse, Nature Mater. **2**, 587-590 (2003).
   "Influence of the Electronic Structure on the Ductile Behavior of B2 CsCl-type AB Intermetallics", K.A. Gschneidner, Jr., Min Ji, C.Z. Wang, K.M. Ho, A.M. Russell, Ya. Mudryk, A.T. Becker and J.L. Larson, Acta Mater. **57**, 5876-5881 (2009).

10. Briefly list the most recent professional development activities
   Founding and senior editor of the *Handbook on the Physics and Chemistry of Rare Earths*, Volumes 1 through 41 (1978-2010).

1. Name: David C. Jiles

2. Education –

B.Sc. (1975) Physics & Mathematics, University of Exeter
M.Sc.(1976) Applied Nuclear Physics, University of Birmingham
Ph.D. (1979) Applied Physics, University of Hull
D.Sc. (1990) Physics & Space Research, University of Birmingham

3. Academic experience

2010 – present Anson Marston Distinguished Professor, Chairman, Department of Electrical & Computer Engineering, Palmer Department Chair Holder, Iowa State University, USA
2005-2010 Royal Society Wolfson Research Fellow, Professor of Magnetics & Director Wolfson Centre for Magnetics, Cardiff University, UK
2003-2005 Anson Marston Distinguished Professor, Iowa State University, USA
1992-2005 Professor of Electrical & Computer Engineering, Iowa State University
1990-2005 Professor of Materials Science & Engineering, Iowa State University
1981-1984 Research Associate, Physics Department, Queen's University, Kingston, Canada
1979-1981 Postdoctoral Fellow, Physics Department, Victoria University, New Zealand
1986-1990 Associate Physicist/Assistant Professor - Physicist/Associate Professor

4. Non-academic experience –

2004-present Chairman, Magnetics Technology UK Ltd
1992-1997 Director, Magnetic
1990-2005 Senior Scientist, Ames Laboratory US Department of Energy
1988-present President, Magnetics Technology Inc.
1984 86 Research Fellow, Ames Laboratory, US Department of Energy
1981-84 Research Associate, Physics Department, Queens University, Canada
1979-81 Post-doctoral Fellow, Physics Department, Victoria University, New Zealand

5. Certifications or professional registrations

1989-2009 Professional Engineer, State of Iowa, P.Eng.
1989-2009 Chartered Engineer, United Kingdom, C.Eng

6. Current membership in professional organizations

- Honorary Fellow, Indian Society for Nondestructive Testing
- Fellow of IEEE, American Physical Society, and 6 other professional societies: IMMM UK, IP UK, IEE UK, IMA UK, MagSoc, and Japan Society for the Promotion of Science
- Royal Society Research Fellow

7. Honors and awards

- Honorary Fellow, Indian Society for Nondestructive Testing (2011)
- Member □□□ (eta-kappa-nu) and □□□ (tau-beta-pi) (2011)

- Honorary Professor, Cardiff University, UK – School of Engineering
- Chairman, United Kingdom & Republic of Ireland Section, IEEE Magnetics Society (2009-10)
- Royal Society Research Fellow (2005-2010)
- Ewing Lecturer, UK Magnetics Society (2005)
- Editor-in-Chief, IEEE Transactions on Magnetics (2005-2011)
- Magnetics Society Distinguished Lecturer (1997-98)
- Editor of IEEE Transactions on Magnetics (1992-2004)

8. Service activities (within and outside of the institution)- Consultant for over 30 organizations--- Expert witness testimony in a number of cases. These included preparation of expert reports, videotaped deposition testimony and court appearances.

9. The most important publications and presentations from the past five years –

a) 571. "Developments in Deep Brain Stimulation using Time Dependent Magnetic Fields", L. J. Crowther, I. C. Nlebedim and D. C. Jiles, J. Applied Physics. 111, 07B32, 2012.
b) 551. "Influence of Reactive Atmosphere on Properties of Cobalt ferrite Thin Films Prepared using Pulsed-laser Deposition", A. Raghunathan, J.E.Snyder and D.C. Jiles. Presented at the Magnetism and Magnetic Materials Conference, Atlanta, Georgia, November 15 -18, 2010. Journal of Applied Physics, 109, 083922, 2011.
c) 557. "NDE for Life Cycle Management in Power Generation", (Invited Keynote Address), National Seminar on Non-Destructive Testing & Evaluation, Science City Auditorium, Kolkata, India, 9-11 December, 2010.

10. Briefly list the most recent professional development activities-

MANAGEMENT COURSES COMPLETED

Practical Leadership for University Management (10 month part time course), Leadership and Delegation, Communicating Effectively, Planning and Controlling work, Leading Change and Implementing Strategy, Cardiff Approach to Project Management

Chairing University Appointment Panels

Conducting Academic Appraisals

Financial Framework of the University

1. Name: Duane D. Johnson
2. Education – Ph.D., Physics, University of Cincinnati, 1985
3. Academic experience

1997-2004 Associate Professor, University of Illinois at Urbana-Champaign, Materials Science & Engineering, Physics (2000-2004), Mechanical Engineering (2001-2004)

2004-2010 Professor, University of Illinois at Urbana-Champaign, Materials Science & Engineering, Physics, and (affiliate) Mechanical Engineering

2009-2010 The Ivan Racheff Professor of Materials Science and Engineering, University of Illinois at Urbana-Champaign

2010- The F. Wendell Miller Professor of Energy Science, Iowa State University of Science and Technology, Department of Materials Science and Engineering, with courtesy appointments in Chemical and Biological Engineering and in Physics.

2010- Adjunct Professor, University of Illinois at Urbana-Champaign, MSE and Physics.

2010-2013 Professor Invité, Ecole Centrale Paris

4. Non-academic experience

1985-1986 Postdoctoral Fellow, University of Bristol, UK

1987-1988 NRC Postdoctoral Fellow, Naval Research Laboratory

1988-1997 Senior Member of Technical Staff, Computational Materials Science Department, Sandia National Laboratory, Livermore, CA

2010- Chief Research Officer, Ames Laboratory/US Department of Energy, Ames, IA

2010- Principle Investigator, Division of Materials Science and Engineering & Division of Chemical and Biological Sciences

5. Certifications or professional registrations: None
6. Current membership in professional organizations: Fellow, American Physical Society, American Chemical Society, The Minerals, Metals, and Materials Society, American Society of Metals, Materials Research Society, Sigma Xi
7. Honors and awards

2003 Fellow of the American Physical Society

2004 Xerox Award for Faculty Research, College of Engineering, U. of Illinois

2005-2008 DCOMP Member-at-Large (elected), American Physical Society (2005-2008)

2005-2010 Bliss Faculty Scholar, College of Engineering, U. of Illinois

2006 GECCO Silver "Humie" Award and Best Paper in Real World Applications track

2008-2010 Chair Elect, Division of Computational Physics, American Physical Society

2009 NSCA Fellow, University of Illinois

2009 Paper selected by AIP Editors as *Viewpoint in Physics* [*Physics* **2**, 64 (2009)].

2010 DoE Hydrogen Program 2010 "Special Recognition Award" for the Metal-Hydride Center of Excellence "In Recognition of Outstanding Contributions to the Department of Energy"

8. Service activities (within and outside of the institution)

1999-2010 National Steering Committee, Recent Developments in Electronic-Structure Workshop

2000- National Steering Committee, Materials Science Critical Technology Sector/Phase Transitions, ASM/TSM

2010-2013 Special Editor for *Computer Physics Communications*

University

1997-2010 Steering Committee, Computational Science and Engineering Program, University of Illinois

2008-2010 Theme Leader (with L. Kale, CS) on "Synergistic Research on Parallel Programming for Petascale Applications," for NSCA BlueWaters applications

2008-2010 College of Engineering Information Services Steering Committee

2005-2007 Provost's Ad Hoc Advisory Committee to IACAT

2006-2010 Vice Chancellor's IT Strategic Planning Steering Team

2007-2010 NSCA Director's IACAT Advisory Board

2007-2010 Provost's Advisory Committee on Illinois Informatics Initiative (I-Cubed).

2011-2012 ISU's Pratt & Whitney Center of Excellence Development Team

2011-2012 Chair, Search Committee for Director, Center for Nondestructive Evaluation

9. D. Sheppard, P. Xiao, W. Chemelewski, D. D. Johnson, and G. Henkelman, "A generalized solid-state nudged-elastic-band method," *J. of Chem. Phys*. **136**, 074103-8 (2012).

   A. Alam and D. D. Johnson, "Chemically Mediated Quantum Criticality in $NbFe_2$," *Phys. Rev. Lett*. **107**, 206401-5 (2011).

   A. Alam, B. G. Wilson, and D. D. Johnson, "Accurate and fast numerical solution of Poisson's equation for arbitrary, space-filling Voronoi polyhedra: near-field corrections revisited," *Phys. Rev. B* **84**, 205106-8 (2011).

   Z. Zhang, L. Li, L.-l. Wang, S. I. Sanchez, Q. Wang, D. D. Johnson, A. I. Frenkel, R. G. Nuzzo, and J. C. Yang, "The Role of γ-Al_2O_3 Single Crystal Support to Pt Nanoparticles Construction," *Microscopy and Microanalysis* **17**(S2), 1324 (2011).

   L. Li, Z. Zhang, J. Ciston, E. A. Stach, L.-L. Wang, D. D. Johnson, Q. Wang, A. I. Frenkel, S. I. Sanchez, M. W. Small, R. G. Nuzzo, and J. C. Yang, "H_2-driven crystallization of supported Pt nanoparticles observed with aberration-corrected Environmental TEM," *Microscopy and Microanalysis* **17**(S2), 1604 (2011).

   T. L. Tan and D. D. Johnson, "Topologically correct phase boundaries and transition temperatures for Ising Hamitonian via self-consistent coarse-grained cluster-lattice models," *Phys. Rev. B* **83**, 144427-12 (2011).

   A. Alam, S. N. Khan, Brian G. Wilson, and D. D. Johnson, "Efficient Isoparametric Integration over arbitrary, space-filling Voronoi polyhedra for electronic-structure calculations," *Phys. Rev. B* **84**, 045105-11 (2011).

   L.-L. Wang and D. D. Johnson, "Ternary Tetradymite Compounds as Topological Insulators," *Phys. Rev. B* **83**, 241309(R) (2011).

   B. G. Wilson, D. D. Johnson, and A. Alam, "Multi-center electronic-structure calculations for plasma equation of state," *High Energy Density Physics* **7**(2), 61-70 (2011).

10. Briefly list the most recent professional development activities

Michael R. Kessler, Ph.D., PE

Education

BS	Mechanical Engineering, LeTourneau University,	1996
Ph.D.	Theoretical and Applied Mechanics, University of Illinois,	2002

Academic Experience

2002-2005	Assistant Professor, Mechanical Engineering, University of Tulsa
2005-2010	Assistant Professor, Materials Science and Eng, Iowa State University
2010-Present	Associate Professor, Materials Science and Eng, Iowa State University

Certifications or Professional Registrations

Registered Professional Engineer in the state of Iowa (Certificate No. 17762), 2006-Present.

Current Membership in Professional Organizations

- American Society of Mechanical Engineers (ASME), 1992–present
- Society for the Advancement of Material and Process Engineering (SAMPE), 1998–present
- American Society for Engineering Education (ASEE), 2001–present
- North American Thermal Analysis Society (NATAS), 2005–present
- American Society for Composites (ASC), 2009–present
- Society of Plastics Engineers (SPE), 2009–present
- ASM International, 2010-present

Honors and Awards

- Iowa State University Award for Early Achievement in Research, 2011.
- Akinc Excellence in Research Award, Materials Science and Engineering Department, 2010-2011.
- Invited participant in the National Academy of Engineering's Frontiers of Engineering Education (FOEE) Symposium, 2010.
- National Science Foundation's CAREER Award, 2010-2015.
- Elsevier Young Composites Researcher Award from the American Society for Composites, 2009.
- Akinc Excellence in Teaching Award, Materials Science and Engineering Department, 2007-2008.
- Air Force Office of Scientific Research Young Investigator Award, 2008-2010.
- Army Research Office Young Investigator Award, 2004-2007.
- Selected as Faculty Escort (Graduate College) for the summer 2007 ISU Commencement Ceremony.

Service Activities (within and outside of the institution)

- Vice Chair for the 19th International Conference on Composite Materials (ICCM19), representing the American region, July 28-August 2, 2013, Montreal, Canada.
- Conference Chair of the 39th Annual Conference of the North American Thermal Analysis Society, August 7-10, 2011, Des Moines, IA.
- Secretary (2007-2008), Treasurer (2008-2009), Program Vice-Chair (2009-2010), Program Chair (2010-2011), Division Chair (2011-2012), New Engineering Educators Division, American Society of Engineering Education.

- Program Chair (2011-2013), Materials Division, American Society of Engineering Education.
- Academic Liaison for the North American Thermal Analysis Society (NATAS), 2006-Present.
- Faculty Leader for SP@ISU – A project funded by the NSF Innovation through Institutional Integration (I^3) program with the mission to support faculty as they develop and integrate broader impact activities into their research program., 2011-present.
- Chair of the Economic Development and Industrial Relations Committee for the Materials Science and Engineering Department, 2010-present.

Ten Representative Recent Publications (from more than 70 peer reviewed journal publications and more than 60 peer reviewed conference proceedings)

1. P. Badrinarayanan, M. K. Rogalski, M. R. Kessler[a]: *Carbon Fiber Reinforced Cyanate Ester / Nano-*ZrW_2O_8 *Composites with Tailored Thermal Expansion*, **ACS Applied Materials and Interfaces**, 2012, 4(2), 510-517.
2. P. Badrinarayanan, M. I. Ahmad, M. Akinc, and M. R. Kessler: *Synthesis, Processing and Characterization of Negative Thermal Expansion Zirconium Tungstate Nanoparticles with Different Morphologies*, **Materials Chemistry and Physics**, 2011, 131, 12-17.
3. X. Sheng, D. M. Rock, T. C. Mauldin, M. R. Kessler: *Evaluation of Different Catalyst Systems for Bulk Polymerization through "Click" Chemistry*, **Polymer**, 2011, 52(20), 4435-4441.
4. P. Badrinarayanan and M. R. Kessler: *Zirconium Tungstate/Cyanate Ester Nanocomposites with Tailored Thermal Expansivity*, **Composites Science and Technology**, 2011, 71, 1385-1391).
5. P. Hondred, S. Yoon, N. Bowler, E. Moukhina, M. R. Kessler: *Degradation Kinetics of Polyimide Wire Insulation*, **High Performance Polymers**, 2011, 23(4), 335-342.
6. S. Bhuyan, S. Sundararajan, X. Sheng, M. Kessler: *Influence of crosslink density on the tribological behavior of norbornene-based polymeric materials*, **Wear**, 2011, 270, 550-554.
7. E. A. Stefanescu, X. Tan, Z. Lin, N. Bowler, M. R. Kessler: *Multifunctional Fiberglass-Reinforced PMMA-*$BaTiO_3$ *Structural/Dielectric Composites*, **Polymer**, 2011, 52, 2016-2024.
8. M. Thunga, W. Y. Lio, M. Akinc, M. R. Kessler: Adhesive Repair of Bismaleimide/Carbon Fiber Composites with Bisphenol E Cyanate Ester, **Composites Science and Technology**. 2010, 71, 239-245.
9. E. A. Stefanescu, X. Tan, Z. Lin, N. Bowler, M. R. Kessler: *Multifunctional PMMA-Ceramic Composites as Structural Dielectrics*, **Polymer**. 2010, 51, 5823-5832.
10. P. Badrinarayanan, K. B. Dowdy, M. R. Kessler: *A Comparison of Crystallization Behavior for Melt and Cold Crystallized Poly (L- lactide) Revealed Using Rapid Scanning Rate Calorimetry*, **Polymer**. 2010; 51, 4611-4618.

1. Name: Alexander H. King

2. Education –1975-1979 **D.Phil.**, University of Oxford, England, *Metallurgy & Science of Materials*-----1972-1975 **B.Met**.(Hons.), University of Sheffield, England, *Physical Metallurgy*

3. Academic experience – 1979-1981: Research Associate, MIT; 1981-1999: Asst. Prof., Assoc. Prof., and Prof. Materials Science & Engineering, SUNY Stony Brook; 1987-1992, Vice Provost for Graduate Studies, SUNY Stony Brook; 1999-2007, Head, School of Materials Engineering, Purdue University; 2008-present: Director of the Ames Laboratory, and Prof. of Materials Science & Engineering, ISU.

4. Non-academic experience – Senior Science Advisor, US Department of State, 2005-06 (as a Jefferson Science Fellow).

5. Certifications or professional registrations – Chartered Engineer (UK PE status).

6. Current membership in professional organizations TMS, ASM International, MRS, Microscopy Soc. of America, APS, AAAS.

7. Honors and awards

2009	Fellow of the Materials Research Society.
2005-06	State Department / National Academies Jefferson Science Fellow
1996	Visiting Fellow of the Japan Society for the Promotion of Science
1995	Fellow of the Institute of Materials of the United Kingdom
1995	Fellow of the American Society for Materials

8. Service activities (within and outside of the institution)
   - President, Materials Research Society, 2002
   - Iowa Department of Economic Development, Energy Sector Committee Member, 2009-10.
   - Member, APS Task Force on Critical Elements for New Energy Technologies, 2010.
   - Chair APS Interest Group on Energy Research and Applications, 2010.
   - MRS Public Affairs Committee Member since 2003.
   - MRS Public Outreach Committee Member since 2004.
   - Technical Advisor for NOVA television series “Making Stuff” (2011) and “Hunt for the Elements” (2012)

9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation
   a) C. Saldana, A. H. King, E. A. Stach, W. D. Compton, and S. Chandrasekar, Appl. Phys. Letts. 99 (2011) 231911: “Vacancies, twins,

and the thermal stability of ultrafine-grained copper." DOI: 10.1063/1.3669404. (This paper is also linked as a publication in the January 2, 2012 issue of the Virtual Journal of Nanoscale Science & Technology.)

b) P. Muellner and A.H. King, Acta Materialia 58 (2010) 5242-5261: "Deformation of hierarchically twinned martensite." DOI: 10.1016/j.actamat.2010.05.048
c) A.H. King, Scripta Materialia 62 (2010) 889-893: "Triple lines in materials science and engineering" (invited viewpoint article). DOI: 10.1016/j.scriptamat.2010.02.020
d) T.L. Brown, C. Saldana, T.G. Murthy, J.B. Mann, Y. Guo, L.F. Allard, A.H. King, W.D. Compton, K.P. Trumble, S. Chandrasekar, Acta Materialia 57 (2009) 5491-5500: "A study of the interactive effects of strain, strain rate and temperature in severe plastic deformation of copper." DOI: 10.1016/j.actamat.2009.07.052
e) H. Kim, Y. Xuan, P.D. Ye, R. Narayanan and A.H. King, Acta Materialia 57 (2009) 3662-3670: "Anomalous triple junction surface pits in nanocrystalline zirconia thin films and their relationship to triple junction energy." DOI: 10.1016/j.actamat.2009.04.032
f) H. Kim, Y. Xuan, P.D. Ye, R. Narayanan and A.H. King, Acta Materialia 57 (2009) 3662-3670: "Anomalous triple junction surface pits in nanocrystalline zirconia thin films and their relationship to triple junction energy." DOI: 10.1016/j.actamat.2009.04.032
g) W.Y. Chang, A.H. King and K.J. Bowman, Journal of Materials Research 24 (2009) 3662-3770: "Effects of residual (or internal) stress on ferroelectric domain wall motion in tetragonal lead titanate ." DOI: 10.1557/JMR.2009.0218
h) S. Shekhar and A.H. King, Acta Materialia 56 (2008) 5728-5736: "Strain Fields and Energies of Grain Boundary Triple Junctions." DOI: 10.1016/j.actamat.2008.07.053
i) M.R. Shankar, B.C. Rao, S. Chandrasekar, W.D. Compton and A.H. King, Scripta Materialia 58 (2008) 675-678: "Thermally Stable Nanostructured Materials from Severe Plastic Deformation of Precipitation-Treatable Ni-Based Alloys." DOI: 10.1016/j.scriptamat.2007.11.040

10. Briefly list the most recent professional development activities- none

1. Name: Mathew Joseph Kramer

2. Education –
   Ph.D. Geology, Iowa State University,1988
   M.S. Geology, University of Rochester, 1983
   B.S. Geomechanics, University of Rochester,1979

3. Academic experience
   1996-present Adjunct Professor: Department of Materials Science and Engineering
   2004-present Senior Scientist, Metallurgy and Physics Program, Ames Laboratory
   2001-present Group Leader, Materials Characterization/Metal & Ceramic Sciences Program
   1988-present Postdoctoral Fellow/Assoc./Scientist, Ames Lab

4. Non-academic experience –
   2004- Senior Scientist, Ames Lab
   1996-2003 Scientist, Ames Lab
   1989-1995 Associate Scientist, Ames Lab
   1988-1989 Postdoctoral Fellow, Ames Lab
5. Certifications or professional registrations-MSE

6. Current membership in professional organizations – Materials Research Society, Microscopy Society of America, TMS

7. Honors and awards-

8. Service activities (within and outside of the institution)-
   - 2012 TMS Annual Meeting symposium organizer for "Processing to Control Morphology and Texture in Magnetic Materials"
   - Spallation Neutron Source Panel Reviewer for Disordered Materials
   - Panel member on the DOE/BES workshop on Materials at their Extremes

9. Briefly list the most important publications and presentations from the past five years –
   a) Kalay, I., M. J. Kramer, and R. E. Napolitano, High-Accuracy X-Ray Diffraction Analysis of Phase Evolution Sequence During Devitrification of Cu50Zr50 Metallic Glass, Metallurgical and Materials Transactions A-Physical Metallurgy and Materials Science 42A (2011), pp. 1144.DOI 10.1007/s11661-010-0531-9
   b) Kramer, M. J., M. I. Mendelev, and R. E. Napolitano, In Situ Observation of Antisite Defect Formation during Crystal Growth, Physical Review Letters 105 (2010) http://dx.doi.org/Doi 10.1103/Physrevlett.105.245501

c) Ray, P. K., T. Brammer, Y. Y. Ye, M. Akinc, and M. J. Kramer, A multi-stage hierarchical approach to alloy design, JOM 62 (2010), pp. 25.DOI 10.1007/s11837-010-0151-2
d) Rieken, J. R., I. E. Anderson, and M. J. Kramer, Grand Prize Gas-Atomized Chemical Reservoir ODS Ferritic Stainless Steels, Int J Powder Metall 46 (2010), pp. 9.
e) Shin, K. Y., N. Ru, I. R. Fisher, C. L. Condron, M. F. Toney, Y. Q. Wu, and M. J. Kramer, Observation of two separate charge density wave transitions in Gd2Te5 via transmission electron microscopy and high-resolution X-ray diffraction, Journal of Alloys and Compounds 489 (2010), pp. 332. http://dx.doi.org/DOI 10.1016/j.jallcom.2009.09.154
f) Srirangam, P., M. J. Kramer, and S. Shankar, Effect of strontium on liquid structure of Al-Si hypoeutectic alloys using high-energy X-ray diffraction, Acta Materialia 59 (2011), pp. 503. http://dx.doi.org/DOI 10.1016/j.actamat.2010.09.050
g) Wei, X., D. Le Roy, R. Skomski, X. Z. Li, Z. Sun, J. E. Shield, M. J. Kramer, and D. J. Sellmyer, Structure and magnetism of MnAu nanoclusters, Journal of Applied Physics 109 (2011) http://dx.doi.org/Doi 10.1063/1.3559502
h) Wang, Y. M., R. T. Ott, A. V. Hamza, M. F. Besser, J. Almer, and M. J. Kramer, Achieving Large Uniform Tensile Ductility in Nanocrystalline Metals, Physical Review Letters 105 (2010) http://dx.doi.org/Doi 10.1103/Physrevlett.105.215502
i) Wu, Y. Q., W. Tang, K. W. Dennis, N. Oster, R. W. McCallum, I. E. Anderson, and M. J. Kramer, Effective grain pinning revealed by nanoscale electron tomography, Journal of Applied Physics 109 (2011) http://dx.doi.org/Doi 10.1063/1.3549603
j) Zhang, Y., M. J. Kramer, C. B. Rong, and J. P. Liu, Microstructure and intergranular diffusion in exchange-coupled Sm-Co/Fe nanocomposites, Applied Physics Letters 97 (2010) http://dx.doi.org/Doi 10.1063/1.3467202

10. Briefly list the most recent professional development activities

1. Richard A. LeSar

2. Education: Ph. D, Chemical Physics, Harvard University, 1981; A. M., Physics, Harvard University, 1977; B. S., Chemistry, University of Michigan, 1975

3. Academic experience: Iowa State University, Professor, Chair, 2006-2012, full time

4. Non-academic experience: Los Alamos National Laboratory, Technical Staff Member (plus numerous management titles), research scientist and program manager and line manager, 1981-2006, full time

5. Certifications or professional registrations: none

6. Current membership in professional organizations: American Physical Society, Materials Research Society, TMS, American Society for Engineering Education

7. Honors and awards: Lynn Gleason Professor of Interdisciplinary Engineering (2011-present)

8. Service activities: ISU: Department Chair, Professional: Editorial Board of Annual Review of Materials Research, Current Opinion in Solid State and Materials Science, and Materials Science and Engineering C. Materials for Biological Applications. Member of the External Advisory Board, UCSB MRSEC.

9. Selected Publications from the past five years

   "Teaching sustainable development in materials science and engineering," R. LeSar, K. C. Chen, and D. Apelian, in press in the *MRS Bulletin*.

   "Dislocation dynamics simulations of plasticity in polycrystalline thin films," C. Zhou and R. LeSar, International Journal of Plasticity 30-31, 185-201 (2012).

   "Plastic deformation mechanisms of *fcc* single crystals at small scales," C. Zhou, I. J. Beyerlein, and R. LeSar, Acta Materialia 59, 7673-7682 (2011).

   "Simulations of the effect of surface coatings on plasticity at small scales," C. Zhou, S. B. Biner, and R. LeSar, Scripta Materialia 63, 1096-1099 (2010).

   "Discrete dislocation dynamics simulations of plasticity at small scales," C. Zhou, S. B. Biner, and R. LeSar, Acta Materialia 58, 1565-1577 (2010).

   "Materials informatics: An emerging technology for materials development," R. LeSar, Statistical Analysis and Data Mining 1, 372-374 (2009).

   "Dislocation dynamics simulation of plastic anisotropy in fcc single crystals in high rate deformation," Z. Q. Wang, I. J. Beyerlein, and R. LeSar, International Journal of Plasticity 25, 26-48 (2009).

   "Slip band formation and mobile density generation in high rate deformation of single fcc crystals," Z. Q. Wang, I. J. Beyerlein, and R. LeSar, Philosophical

Magazine 88, 1321-1343 (2008).

"Dislocation motion in high-strain-rate deformation." Z. Q. Wang, I. J. Beyerlein, and R. LeSar, Philosophical Magazine 87, 2263-2279 (2007).

Selected Invited Presentations:

"Connecting Dislocation Simulations to Plasticity", Workshop on *Complex Dynamics of Dislocations, Defects and Interfaces,* Los Alamos 11/11

"Plasticity at Small Scales," *TMS Annual Meeting*, San Diego, CA 2/11

"Study Abroad Experiences in the Developing World: Opportunities and Challenges," with K. M. Bryden, *MRS Fall Meeting*, Boston, MA 12/10

"Computational Materials Science and Engineering: Opportunities and Challenges," 2010 Kreidl Memorial Lecturer, 22nd Annual Rio Grande Symposium on Advanced Materials, Albuquerque, NM 10/10

"Plasticity at Small Scales," Institute for High Performance Computing, A*STAR, Singapore 6/10

"Biomolecular Assemblies as Mechanical Systems," *TMS Annual Meeting*, Seattle, WA 2/10

"Teaching Sustainable Engineering," with K. M. Bryden, *Engineering Solutions for Sustainable Development*, Lausanne, Switzerland, 7/09

"Teaching Appropriate Technology in the Developing World: Educating Engineers in 21st Century Challenges," with K. M. Bryden, *MRS Spring Meeting*, 4/09

"Preparing for Future Challenges: Teaching Appropriate Technology in Africa," Department of Mechanical Engineering, King's College (London), 3/09

"Small-Scale Plasticity," Department of Mechanical Engineering, King's College (London), 3/09

"Plasticity on a Computer," Department of Materials Science and Engineering, University of Illinois, 12/08

"Coarse Graining of Dislocations: A Status Report," Materials and Manufacturing Directorate, Air Force Research Laboratory, Materials Directorate, 8/08

"Teaching Appropriate Technology in Africa," with K. M. Byden, International Center for Materials Research, UCSB, 4/08

"Theory and Simulation of Dislocation Structure and Response," Department of Materials Science and Engineering, Georgia Tech University, 4/08

"Scale-Free Intermittent Flow in Crystal Plasticity," *APS March Meeting*, New Orleans, 3/08

10. Professional development activities: none

1. Name- Surya K. Mallapragada

2. Education – 1996---Ph.D., Chemical Engineering, Purdue University
   1993---B. Tech, Chemical Engineering, Indian Institute of Technology, Bombay, India

3. Academic experience
   2009- Chair, Department of Chemical and Biological Engineering, Iowa State University
   2009- Stanley Chair in Interdisciplinary Engineering, Iowa State University
   2008 Visiting Researcher, Department of Chemical Engineering, California Institute of Technology. Collaborator: Dr. David Tirrell
   2006- Professor, Departments of Chemical & Biological Engineering and Materials Science & Engineering (courtesy), Iowa State University
   2001-2006 Associate Professor, Departments of Chemical & Biological Engineering and Materials Science & Engineering (courtesy), Iowa State University
   1999 - Affiliate, Neuroscience Program, Iowa State University
   1996-2001Assistant Professor, Dept. of Chemical Engineering, Iowa State University
   1996 Postdoctoral Researcher, Dept. of Chemical Engineering, MIT

4. Non-academic experience –
   2006-07 Member, Defense Sciences Study Group, Institute for Defense Analyses (part-time)
   2004-2008 Program Director, Materials Chemistry and Bimolecular Materials, Ames Laboratory, U.S. Department of Energy (part-time)
   1999 - Scientist, Ames Laboratory, U.S. Department of Energy (part-time)

5. Certifications or professional registrations- none

6. Current membership in professional organizations-
   Amer. Assoc. for the Adv. of Science
   American Institute for Medical and Biological Engineering
   American Institute of Chemical Engineers
   American Chemical Society
   American Soc. for Engineering Education
   Biomedical Engineering Society
   Controlled Release Society
   Materials Research Society
   Sigma Xi
   Society for Biomaterials
   Tau Beta Pi

7. Honors and awards-

2011 Young Alumni Achievement Award, Indian Institute of Technology, Bombay

2009 Distinguished Service Award, AIChE Food, Pharmaceutical and Bioengineering Division
2008 Fellow, American Association for the Advancement of Science
2007 Big 12 "Rising Star" Award, Big 12 Center for Economic Development, Innovation and Commercialization
2007 ISU Foundation Mid-career Excellence in Research Award
2007 Honoree, Iowa Distinguished Faculty in Engineering Lecture Series
2006 Fellow, American Institute of Medical and Biological Engineering
2006 Invited Participant, National Academy of Eng. U.S. Frontiers of Eng. Symposium
2003 Global Indus Technovator Award
2002 TR100 Award, MIT's Technology Review Magazine
2001 3M Non-Tenured Faculty Award
2001 ISU Foundation Early Excellence in Research Award
2000 NSF CAREER Award

8. Service activities

2010-2013 Member, Executive Board of National Program Committee, AIChE
2009 Reviewer, DOE-BES Sandia National Lab programs
2008 Chair, AIChE Food, Pharmaceutical and Bioengineering Division
2007 Chair, AIChE Food, Pharmaceutical and Bioengineering Division, Pharmaceutical Area
2003-2006 Treasurer, AIChE Food, Pharmaceutical and Bioengineering Division
2006-10 Member, NIH Biomaterials and Biointerfaces (BMBI) Study Section
1996-2011 Several internal service activities at Iowa State University including Graduate co-ordinator in CBE, CBE Honors and Awards committee, CBE Faculty search committee, CBE Associate Chair, ISU Provost search committee, NSF-AGEP selection committee, Ames Lab Chief Research Officer Selection committee, OIPTT Director search committee, Faculty Advisor for Tau Beta Pi
1996-2011 Served as session chair/symposium organizer for various AIChE, ACS, BMES, NATAS, MRS conferences

9. The most important publications and presentations from the past five years –

- Peterson, L., Oh, J., Sakaguchi, D., Mallapragada, S.K., and Narasimhan, B., "Amphiphilic Polyanhydride Films Promote Neural Stem Cell Adhesion and Differentiation," *Tissue Eng.*, **17**, 2533-41 (2011).
- Zhang, B., and Mallapragada, S.K., "The Mechanism of Selective Transfection Mediated by Pentablock Copolymers: Part I. Investigation of Cellular Uptake," *Acta Biomaterialia*, ***7***, 1570-79 (2011).
- Zhang, B., and Mallapragada, S.K., "The Mechanism of Selective Transfection Mediated by Pentablock Copolymers: Part II. Nuclear Entry and Endosomal Escape," *Acta Biomaterialia*, **7**, 1580-87 (2011).

10. Briefly list the most recent professional development activities-2009-10 Emerging Leaders Academy, Iowa State University

1. Name
   Michael (Hogan) E. Martin, Ph.D.

2. Education – degree, discipline, institution, year
   Ph.D. Materials Science & Engineering (Cornell University) Jan 1993 M.S. Materials Science & Engineering (Cornell Univ.) Aug. 1989

   B.S. Metallurgical Engineering (Iowa State Univ. 3.8/4.0) May 1986

   note: Mathematics minor granted with Ph.D. and with B.S.

3. Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 1990-1995), full time or part time

   Iowa State University, Department of Materials Science and Engineering: Senior Lecturer (2009-Present) Lecturer (2003-2009). Developed and delivered curriculum for Engr 160, Mat E 211 lab, Mat E 214 lecture and lab, Mat E 215L, Mat E 351, Mat E 413 and 414. Undergraduate Academic Advising. Maintenance, Management and Repair of teaching lab equipment. Supervision of Graduate Laboratory Support Assistants.

   Iowa State University, Department of Materials Science and Engineering: Laboratory Instructor (Fall '02). Administered lab exercises and delivered lectures regarding the same.

   Ames Laboratory U.S.D.O.E.: Post-doctoral Scientist (Summer – Fall '02). Directional Solidification of Transparent Model Systems (under Rohit Trivedi).

   University of Denver, Department of Mathematics and Computer Science: Adjunct Professor (Spring '00). Developed curriculum, administered course and delivered lectures on basic mathematics to first- and second-year humanities students.

   University of Arizona, Department of Materials Science and Engineering: Research Professor / Post-Doctoral Assistant. (Feb '95 - June '96). Development of ceramic based rapid prototyping technology. Assistant taught introductory materials science course for undergraduate engineering students.

   Sandia National Laboratory, Ceramic Processing Science: Post-Doctoral Fellow (Feb '93 - Feb '95). Basic research in biomimetic materials / hierarchical structures. Applications include: artificial bone, optical computing devices. Q-clearance granted August 93.

4. Non-academic experience – company or entity, title, brief description of position, when (ex. 1993-1999), full time or part time

5. Certifications or professional registrations

6. Current membership in professional organizations

7. Honors and awards

   IBM Ceramics Fellowship (1989-90, 1990-91, 1991-92)
   Tau Beta Pi Fellow (1986-present)
   Varsity Gymnastics Scholarship (1985-1986)
   Big 8 Athletic Conference Academic Honor Roll (1985)
   First Place Iowa State University Math Olympics (1984)
   Student-Athlete of the Year 1983 - Iowa State University

8. Service activities (within and outside of the institution)

   Faculty Advisor: ISU Engineers Without Borders
   Faculty Advisor: ISU Cycling Club
   Board Member: Friends of Central Iowa Bicycling

9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

   Attended and presented at "National Capstone Design Course Conference, 2007" – "Capstone Design in Materials Engineering at Iowa State University"

10. Briefly list the most recent professional development activities

   Participated in "Introduction to Learning-Centered College Classrooms" workshop Summer 2005. Ames, IA

   Attended and presented at "National Capstone Design Course Conference, 2007" Boulder, CO

   Attended "3rd North American Materials Education Symposium"
   California Polytechnic State University /San Luis Obispo, CA
   Materials Selection w/ Edupack Workshops 27,28March, General Symposia 29-31March 2012

1. Name: Steve Martin

2. Education –B.A. Chemistry, Capital University, Bexley, OH, May 1980
   Ph.D. Physical Chemistry, Purdue University, West Lafayette, IN, May 1986

3. Academic experience –

2010 Visiting Professor, Department of Materials Science and Engineering, Changwon National University, Changwon, Gyeongnam-Do, South Korea
2010 Visiting Professor, Department of Materials Science and Engineering, Gyeongsang National University, Jinju, Gyeongnam-Do, South Korea
2009-Present Anson Marston Distinguished Professor in EngineeringDepartment of Materials Science & Engineering, ISU
2009 Visiting Professor, Department of Materials Science and Engineering, Changwon National University, Changwon, Gyeongnam-Do, South Korea
2009 Co-Director, Zero Carbon Energy Systems Research Center Working Group, College of Engineering, Iowa State University
2007-2008 Director of Graduate Education, Department of Materials Science & Engineering, ISU
2006- present University Professor, Department of Materials Science & Engineering, ISU
2006 Visiting Professor, Department of Applied Physics, Kumoh National Institute of Technology, Gumi, Korea
2005 Visiting Professor, Department of Physics, University of Messina, Messina, Italy
2005 Visiting Professor, Department of Applied Physics, Chalmers University of Technology, Göteborg, Sweden
1996-2006 Full Professor, Materials Science & Engineering Department, ISU
1991-1995 Associate Professor, Materials Science & Engineering Department, ISU
1986-1991 Assistant Professor, Materials Science & Engineering Department, ISU
1982-1986 Research Assistant, Department of Chemistry, Purdue University
1980-1982 Freshman Chemistry Teaching Assistant, Department of Chemistry, Purdue University

4. Non-academic experience –

2008 - present Associate Staff Member, Ames Laboratory, Division of Materials Science & Engineering
2004 - 2008 Associate Staff Member, Ames Laboratory, Division of Materials Engineering and Physics
1993-- 2004 Associate Staff Member, Ames Laboratory, Condensed Matter Physics Division
1986-1991 Assistant Professor, Engineering Research Institute, Iowa State University
1986-1992 Associate Staff Member, Ames Laboratory, Metallurgy & Ceramics Division

5. Certifications or professional registrations- none

6. Current membership in professional organizations-

- Electrochemical Society
- American Ceramic Society, Glass & Optical Materials Division, Ceramic Education Council
- American Society for Engineering Educators
- Corning Museum of Glass
- International Society for Solid State Ionics

7. Honors and awards

- American Ceramic Society, Glass and Optical Materials Division, Chair of the Glass and Optical Materials Division, October 2011.
- Iowa State University, Sigma XI Chapter President Award, April 2011.
- Iowa State University, Department of Materials Science & Engineering, Akinc Excellence in Teaching Award, April 2010
- Anson Marston Distinguished Professor of Engineering, Department of Materials Science & Engineering, ISU, September 2009

8. Service activities (within and outside of the institution)

- Co-principal investigator for NSF funded, $170,000/year, "Research careers for minority scholars program." This project seeks to increase the number of minorities who attain Ph.D.'s in engineering. So far over twenty minorities have graduated from our program and attended graduate school in engineering. May 1993 – May 1998.

9. Briefly list the most important publications and presentations from the past five years
   Christensen, Randilynn, Byer, Jennifer, Olson, Garrett, Martin, Steve W., "Atomistic Understanding of the Mixed Glass Former Effect in Sodium Borophosphate Glasses," Journal of Non-Crystalline Solids, Submitted, January 2012.

10. Briefly list the most recent professional development activities

1. Name- William R. McCallum

2. Education –
   B.A. Mathematics and Physics, Carleton College, Northfield, MN, 1969
   M.S. Physics, University of California, San Diego, CA, 1973
   Ph.D. Physics, University of California, San Diego, CA, 1977,
   Postdoctoral Fellowship: Institute for Pure and Applied Physical Sciences, University of California, San Diego, CA (1977-78)

3. Academic experience –
   1991-Present Adjunct Professor, Materials Science and Engineering, ISU
   1987-1991 Adjunct Associate Professor, Materials Science and Engineering, ISU

4. Non-academic experience-
   1986-Present Senior Materials Scientist, Ames Laboratory, USDOE, ISU
   1996-2002 Director, Rare-earth Information Center, Iowa State University, Ames, IA
   1982-1986 Senior Research Physicist, Energy Conservation Devices, Troy, MI
   1978-1982 Scientific Staff Member, Institut fur Festkorperforshung der Kernforschungsanlage Julich, Julich, West Germany.

5. Certifications or professional registrations- none

6. Current membership in professional organizations-none

7. Honors and awards
   - DOE Materials Sciences Award, Sustained Outstanding Research in Solid State Physics, 1995
   - DOE Materials Sciences Award, Significant Implication for DOE Related Technologies, Metallurgy and Ceramics, 1996
   - R&D 100 Award, Nan crystalline Composite Coercive Magnet Powders, 1997

8. Service activities- none

9. Briefly list the most important publications and presentations from the past five years –
   a) Effects of Ag additions on melt-spun RE2Fe14B microstructure and texture; Oster, N. T.; Cavanaugh, D. T.; Dennis, K. W.; Kramer, M. J.; McCallum, R. W.; Anderson, I. E.; Journal of Applied Physics (2012), 111(7), 07A723/1-07A723/3.
   b) Studies of microstructure and magnetic properties in sintered mixed rare earth (MRE)-Fe-B magnets (MRE = Nd+La+Dy); Tang, W.; Wu, Y. Q.; Dennis,

K. W.; Oster, N. T.; Kramer, M. J.; Anderson, I. E.; McCallum, R. W.; Journal of Applied Physics (2011), 109(7), 07A704/1-07A704/3.

c) Flux requirements for the growth of RFeAsO (R = rare earth) superconductors; Yan, J.-Q.; Jensen, B.; Dennis, K. W.; McCallum, R. W.; Lograsso, T. A.; Applied Physics Letters (2011), 98(7), 072504/1-072504/3.

d) Metastability of ferromagnetic Ni-Mn-Sn Heusler alloys; Yuhasz, W. M.; Schlagel, D. L.; Xing, Q.; McCallum, R. W.; Lograsso, T. A.; Journal of Alloys and Compounds (2009), 492(1-2), 681-684.

e) Flux growth at ambient pressure of millimeter-sized single crystals of LaFeAsO, LaFeAsO1-xFx, and LaFe1-xCoxAsO; Yan, J.-Q.; Nandi, S.; Zarestky, J. L.; Tian, W.; Kreyssig, A.; Jensen, B.; Kracher, A.; Dennis, K. W.; McQueeney, R. J.; Goldman, A. I.; et al; Applied Physics Letters (2009), 95(22), 222504/1-222504/3.

f) Synthesis, thermal stability and magnetic properties of the Lu1-xLaxMn2O5 solid solution; Ma, C.; Yan, J.-Q.; Dennis, K. W.; McCallum, R. W.; Tan, X.; Journal of Solid State Chemistry (2009), 182(11), 3013-3020.

g) Effect of oxygen content on the magnetic properties of multiferroic YMn2O5+?; Ma, C.; Yan, J-Q.; Dennis, K. W.; Llobet, A.; McCallum, R. W.; Tan, X.; Journal of Physics: Condensed Matter (2009), 21(34), 346002/1-346002/5.

h) In situ high energy X-ray synchrotron diffraction study of the synthesis and stoichiometry of LaFeAsO and LaFeAsO1-xFy; McCallum, R. W.; Yan, J.-Q.; Rustan, G. E.; Mun, E. D.; Singh, Yogesh; Das, S.; Nath, R.; Bud'ko, S. L.; Dennis, K. W.; Johnston, D. C.; et al; Journal of Applied Physics (2009), 105(12), 123912/1-123912/11.

i) Magnetic properties and microstructure of gas atomized MRE2(Fe,Co)14B powder with ZrC addition (MRE = Nd + Y + Dy); Tang, W.; Wu, Y. Q.; Dennis, K. W.; Oster, N. T.; Kramer, M. J.; Anderson, I. E.; McCallum, R. W.; Journal of Applied Physics (2009), 105(7, Pt. 2), 07A728/1-07A728/3.

j) Correlation of the energy product with evolution of the nanostructure in the Y,Dy,Nd-(Fe, Co)-B magnetic alloy; Wu, Y. Q.; Tang, W.; Kramer, M. J.; Dennis, K. W.; Oster, N.; McCallum, R. W.; Anderson, I. E.; Journal of Applied Physics (2009), 105(7, Pt. 2), 07A720/1-07A720/3.

k) Influence of annealing and phase decomposition on the magnetostructural transitions in Ni50Mn39Sn11 ; Yuhasz, W. M.; Schlagel, D. L.; Xing, Q.; Dennis, K. W.; McCallum, R. W.; Lograsso, T. A.; Journal of Applied Physics (2009), 105(7, Pt. 3), 07A921/1-07A921/3.

l) Probing Fractal Magnetic Domains on Multiple Length Scales in Nd2Fe14B; Kreyssig, A.; Prozorov, R.; Dewhurst, C. D.; Canfield, P. C.; McCallum, R. W.; Goldman, A. I.; Physical Review Letters (2009), 102(4), 047204/1-047204/4. Language:

10. Briefly list the most recent professional development activities- None

1. Name: Ralph E. Napolitano

2. Education: University of Florida B.S., Materials Science and Engineering, 1989
Georgia Institute of Technology M.S., Materials Science and Eng.,1994
Georgia Institute of Technology Ph.D., Materials Science and Eng., 1996

3. Academic experience: Iowa State University, Department of Materials Science and Engineering, Assistant Professor (8/00-7/05); Associate Professor (8/05-8/11); Professor (8/11-present); Alan and Julie Renken Professor (2009-Present)

4. Non-academic experience: Charleston Naval Shipyard, *Nuclear Engineer*, Engineering and Special Projects, Charleston, South Carolina (5/89-11/89); Babcock & Wilcox, *Research Engineer, Supervisor (Fatigue and Fracture Laboratory),* Research & Development Division, Lynchburg Research Center, Lynchburg, Virginia (11/89-8/92).; National Institute of Standards and Technology, *National Research Council Postdoctoral Fellow*, Metallurgy Division, Materials Science and Engineering Laboratory, Gaithersburg, Maryland (1/97-10/98); Ames Laboratory, *Associate Scientist* (10/98-7/05), *Scientist* (8/05-Present) Division of Materials Sciences and Engineering, Ames, Iowa.

5. Certifications or professional registrations-none

6. Current membership in professional organizations: The Minerals, Metals, and Materials Society; ASM International; American Institute of Aeronautics and Astronautics; The American Society for Engineering Education; The American Ceramic Society; The Association for Iron and Steel Technology

7. Honors and Awards:

- Alan and Julie Renken Professorship in Materials Science and Engineering. Iowa State University, MSE Department, 2009
- Department of Materials Science, Excellence in Teaching Award- Iowa State University, MSE Department, 2009;
- Young Engineering Faculty Research Award- Iowa State University, College of Engineering, 2006
- Department of materials Science, Excellence in Research Award- Iowa State University, MSE Department, 2004
- Inducted to the Council of Outstanding Young Engineering Alumni-Georgia Institute of Technology, 2000
- NRC Postdoctoral Fellowship-National Research Council, 1996;
- Outstanding Doctoral Thesis Award- Sigma Xi Scientific Research Society, Georgia Tech Chapter, 1996
- Student Leadership Scholarship for International Study-Georgia Tech Alumni Association, 1995
- SAIC Paper Competition Winner-Science Applications International Corporations, 1995
- NSF Traineeship for Composites Research-National Science Foundation, 1994;

- TMS Symposium on Super alloys Scholarship-The Minerals, Metals, and Materials Society, 1994
- Inducted into the Alpha Sigma Mu Honorary MSE Fraternity- The Georgia Tech Chapter of Alpha Sigma Mu, 1993
- Grodsky Outstanding Senior Scholarship- University of Florida, Department of Materials Science and Engineering, 1989

8. Service Activities: (Selected examples within and outside of the institution): Iowa State University: Faculty Senate (2008-present); Honors Mentor Program (2002-present); ADVANCE Professor (2009-2011); Computation Advisory Committee; Mathematics Liaison Committee (2001-2005). College of Engineering: Engineering Caucus (2011-present); Dean's Budget Advisory Committee (2012); Materials Research Coordinator for Pratt & Whitney Center of Excellence (2011-Present); Engineering Task Force on Graduate Student Teaching (2010). MSE Department: Chair, Strategic Planning Committee (2009-10); Director of Graduate Education (2004-2007); Chair, Computing Committee (2000-2004).Conference Organization: ICAA13 - 13th International Conference on Alloy Solidification and Processing (2012); ICASP3-International Advisory Committee- International Conference on Alloy Solidification and Processing, 2010; Symposium Organization: Thermal Analysis of Amorphous Metals , North American Thermal Analysis Society Conference, Des Moines, IA, 2011; Frontiers in Solidification Science III- TMS Annual Meeting, San Francisco, CA, 2009; Review Panels: DOE Early Career Research Program Review Panel, U.S. Department of Energy, December 15, 2010 - February 1, 2011; NSERC Site Visit Review Panel, University of British Columbia, Vancouver, February 23-25, 2011; NSF MPM Division Design and Manufacturing Innovation Review Panel , NSF headquarters, Arlington, VA Jan 4-5, 2007. Society Leadership: Chair, TMS Solidification Committee (2002-2004); Chalmers Award Selection Committee (2002-2008); TMS Programming Committee (2005-2008). Editorial: Editorial Board Key Reader-Metallurgical and Materials Transaction

9. The most important publications and presentations from the past five years –

- R. E. Napolitano and Melis Serefoglu, "Control and interpretation of finite-size effects and initial morphology in directional solidification of a rod-type eutectic transparent metal-analog," *Journal of Metals* 64 (2012) 68-75.
- Melis Serefoglu, R.E. Napolitano, Mathis Plapp, "Phase-field investigation of rod eutectic morphologies under geom. confinement," Phys. Rev. E 84(1) (2011) 011614.
- M. Serefoglu and R.E. Napolitano, "On the role of initial conditions in the selection of eutectic onset mechanisms in directional growth," *Acta Mater.* 59 (2011) 1048-1057.
- S.G. Hao, C.Z. Wang, M.Z. Li, R.E. Napolitano, "Dynamic Arrest and Glass Formation Induced by Self-Aggregation of Icosahedral Clusters in $Zr_{1-x}Cu_x$ Alloys," *Physical Review B* **84** (2011) 064203.
- M. J. Kramer, M. I. Mendelev, and R. E. Napolitano, "In situ observation of lattice defect formation during crystal growth," *Phys. Rev. Lett.* 105 (2010) 245501.
- Y. Yao, R. Napolitano, C.Z. Wang, and K.M. Ho, "Thermody. limits of crystallization and the prediction of glass formation tendency", *Phys. Rev. B. 81 (2010) 212202.*

10. Briefly list the most recent professional development activities-none

1. Name: Vitalij Pecharsky

2. Education – M.S. (with distinction)- L'viv State University, 1976- Major in Chemistry; Minors-Physics and Mathematics
   Ph.D.- L'viv State University, Department of Inorganic Chemistry, L'viv, Ukraine, 1979. Major in Crystallography. Minors- Solid State Chemistry and Metallurgy

3. Academic experience – Distinguished Professor, Department of Materials Science and Engineering, Iowa State University, 2006 – to date (Professor, 2000-2006, Associate Professor 1998-2000); Associate Professor, Department of Inorganic Chemistry, Lviv State University, Lviv, Ukraine, 1985-1993 (Assistant Professor, 1979-1985).

4. Non-academic experience – Ames Laboratory U.S. Department of Energy, Field Work Proposal Leader, part time, 2008-to date (Senior Scientist, 2000-2008, part time; Scientist, 1998-2000, part time, Associate Scientist, 1998-2000, part time, and 1995-1998 full time, Visiting Scientist, 1993-1995, full time)

5. Certifications or professional registrations - None

6. Current membership in professional organizations – International Centre for Diffraction Data, Materials Research Society

7. Honors and awards
   - Elected as a member of the International Steering Committee of the International Conference on Solid Compounds of Transition Elements. September 2010
   - David R. Boylan Eminent Faculty Award for Research from Iowa State University, College of Engineering, June 2009
   - Named Anson Marston Distinguished Professor of Engineering, July1,2006
   - Materials Science and Engineering Department Excellence in Research Award, 2003
   - Innovative Housing Technology Awards: Coming of Age Award for Magnetic Refrigerator by the National Association of Home Builders, Atlanta, GA. In collaboration with K.A. Gschneidner, Jr, 2003
   - 2002 Federal Laboratory Consortium's Mid-Continent Award for Outstanding Regional Partnership between DOE's Ames Laboratory (AL) and Astronautics Corporation of America (ACA) on "Magnetic Refrigeration Technology". In collaboration with K.A. Gschneidner, Jr. (AL) and C.B. Zimm (ACA). September 19, 2002
   - Winner of the US DOE's Energy100 Award for the "Magnetic Refrigeration Unit." In collaboration with K.A. Gschneidner, Jr. January 2001.

- 1997 DOE Materials Sciences Award for Significant Implication for Department of Energy Related Technologies in the Metallurgy and Ceramics. Research “The Giant Magnetocaloric Effect Materials, $Gd_5(Si_xGe_{1-x})_4$, and their Impact on Refrigeration Technologies”. October, 1997.

8. Service activities – ISU Distinguished Professor Selection Committee (2007-2012); Associate Chair for Research and Economic Development and DOGE (2010 – to date); Chair, P&T Committee (2007-to date); Editor, Journal of Alloys and Compounds, Elsevier, The Netherlands (2012-todate); Editor of the Handbook on the Physics and Chemistry of Rare Earths, Elsevier, The Netherlands. (Together with K.A. Gschneidner and J.-C. Bunzli); Member of the International Advisory Committees of the following conferences: Solid Compounds of Transition Elements (Europe); International Conference of f-elements (Europe); Rare Earth Research Conference (USA); Thermag – Magnetic Refrigeration Conference (Worldwide).

9. Most important publications – 344 refereed papers, 38 chapters in books, 14 patents, 1 book authored:
   a. S. Velez, J.M. Hernandez, A. Garcia-Santiago, J. Tejada, V.K. Pecharsky, K.A. Gschneidner, Jr., D.L. Schlagel, T.A. Lograsso, and P.V. Santos, :Anisotropic Mmagnetic deflagrations in single crystals of Gd_5Ge_4,” Phys. Rev. B **85**, 054432/1-10 (2012).
   b. Ya. Mudryk, N.K. Singh, V.K. Pecharsky, D.L. Schlagel, T.A. Lograsso, and K.A. Gschneidner, Jr., “Magnetic and structural properties of single-crystalline Er_5Si_4,” Phys. Rev. B **85**, 094432/1-10 (2012).
   c. T. Kobayashi, I.Z. Hlova, N.K. Singh, V.K. Pecharsky, and M. Pruski, “Solid-state NMR study of Li-assisted dehydrogenation of ammonia borane,” Inorg. Chem. **51**, 4108-4115 (2012).
   d. Ya. Mudryk, V.K. Pecharsky, and K.A. Gschneidner, Jr., “Extraordinary responsive intermetallic compounds: the R_5T_4 family (R=rare earth, T = group 13-15 elements),” Z. Anorg. Allg. Chem. **637**, 1948-1956 (2011).
   e. Y. Mudryk, D. Paudyal, V.K. Pecharsky, K.A. Gschneidner, Jr., S. Misra, and G.J. Miller, “Controlling magnetism of a complex metallic system using atomic individualism,” Phys. Rev. Lett. **105**, 066401/1-4 (2010).
   f. S.G. Lu, Z. Fang, E. Furman, Y. Wang, Q.M. Zhang, Y. Mudryk, K.A. Gschneidner, Jr., V.K. Pecharsky, and C.W. Wan, “Thermally mediated multiferroic composites for the magnetocaloric materials,” Appl. Phys. Lett. **96**, 102902/1-3 (2010).
   g. V.K. Pecharsky and P.Y. Zavalij, “Fundamentals of Powder Diffraction and Structural Characterization of Materials”, Second, revised edition, Springer, (2009) 744 p.

10. Recent professional development activities – Professional Development Leave as a Visiting Professor, Max Plank Institute for Chemical Physics of Solids, Nöthnitzer Straße, 40, 01187 Dresden, Germany (Fall, 2008)

1. Name-Krishna Rajan

2. Education – Massachusetts Institute of Technology: Major: Materials Science Sc.D. 1978
   University of Toronto: Metallurgy & Materials Science B.A.Sc. 1974

3. Academic experience –
   2005- Present Iowa State University: Professor of Materials Science and Engineering
   2007- Present Iowa State University- Director, Institute for Combinatorial Discovery
   2006- Present Iowa State University: Professor- Bioinformatics & Computational Biology Graduate Program
   2011- Present Ames National Laboratory- Associate Research Scientist
   2006-2009 Iowa State University: Stanley Chair of Interdisciplinary Engineering
   1993- 2005 Rensselaer Polytechnic Institute: Professor of Materials Science

4. Non-academic experience –
   1982-1984 National Research Council of Canada: Research staff scientist

5. Certifications or professional registrations- none

6. Current membership in professional organizations-
   - Member advisory Board: NSF Global School for Advanced Studies: http://www.materialsworldnetwork.org/gsas_new/index.php
   - Member executive committee: Nanoinformatics 2010 , 2011: NSF- National Nanomanufacturing Initiative
   - Panel Member: Evolution and Control of Complexity: Key Experiments Using Sources of Hard X-ray – Dept. of Energy
   - Panel Member: DOE Extreme Environment
   - Director: NSF International Materials Institute: Combinatorial Sciences and Materials Informatics Collaboratory
   - Member US National Research Council- Committee on Data Science and Technology;
   - Co-chair NSF Cyber Infrastructure Workshop for Materials Science ;
   - Steering Committee, Pacific Northwest National Laboratory committee on Materials Informatics;
   - Panel Member -Department of Energy: Materials Under Extreme Behavior

7. Honors and awards-
   - Citation by Editor as key paper published in Acta. Cryst. B- Int. Union of Crystallography (IUCr) 2012 Newsletter*: Structure maps for*

AI4AII6(BO4)6X2 apatite compounds via data mining: P.V. Balachandran and K. Rajan ; Acta Crystallographica B – Acta Cryst. B68, 24-33 (2012)

- Wilkinson Professorship of Interdisciplinary Engineering -2011
- CSIRO- Australia: Distinguished Visiting Scientist Fellowship Award- 2011
- Citation as among top ten papers in Proc. Royal Soc. A for 2011: *Identifying the "inorganic gene" for High Temperature Piezoelectric Perovskites through Statistical Learning* P. Balachandran, S.R. Broderick and K. Rajan; Proceeding Royal Society A 467: 2271-2290 (2011)
- Citation as among top ten papers in ACS Combinatorial Sciences for 2011: *Combinatorial Materials Libraries: Review of State of the Art:* R. Potyrailo, K. Rajan, K. Stoewe, I. Takeuchi, B. Chisholm, and H. Lam; ACS Combinatorial Sciences 13 (6) 579-633 (2011)
- Akinc Research Award- Iowa State University-2009
- Plenary Lecture Award: Society for Industrial and Applied Mathematics (SIAM) – Data Mining Conference: 2008
- NSF Scientific Visualization Competition-Honorable Mention- 2006
- Richard H. *&* Mary Jo Stanley Chair Professorship for Interdisciplinary Engineering – 2006
- CNRS Visiting Professor for Combinatorial Chemistry- Rennes, France-2001
- Visiting Fellowships:
- Max-Planck Institüt für Metallförschung –1992
- Slovak Academy of Sciences- 1999
- National Research Council / National Academy of Engineering E. Europe Fellowship: 1996

8. Service activities *(only those recent appointments at Iowa State University are listed)*

   College of Engineering Committees
   - 1. Bailey Award Committee
   - 2. Mechanical Engineering Department Chair Search Committee
   - 3. Chair: Cluster Hire Committee

   University Committees
   - 4. Research Facilities Committee
   - 5. 2050 Challenge committee
   - 6. NSF- EPSCoR committee

9. Briefly list the most important publications and presentations from the past five years –
   a) "omics" for Materials Science via Informatics
      Symposium on Materials Informatics
      Search Society Fall 2012 meeting
      Boston MA; Nov. 26th-30th 2012

10. Briefly list the most recent professional development activities- none

1. NAME Alan M. Russell

2. EDUCATION

Ph.D.	Iowa State University	Metallurgy	1994
M.S.	Iowa State University	Metallurgy, Nuclear Engineering, and Journalism/Mass Communications	1975
B.S.	Iowa State University	Metallurgical Engineering	1972

3. ACADEMIC EXPERIENCE (all positions were/are full-time)

Senior Materials Scientist, Ames Laboratory of the U.S. Department of Energy Ames Laboratory, 2007-present

Professor, Materials Science & Engineering Department, Iowa State University, 2005-present

Associate Professor, Materials Science & Engineering Department, Iowa State University, 1999-2005

Associate Scientist, Ames Laboratory, 1990-2007

Assistant Professor, Materials Science & Engineering Department, Iowa State University, 1996-1999

Assistant Professor, Engineering Fundamentals & Multidisciplinary Design, Iowa State University, 1990-1996

Assistant Dean and Assistant Professor, Engineering Administration and Freshman Engineering, Iowa State University, 1980-1984

Assistant to the Dean and Assistant Professor, Engineering Administration and Freshman Engineering, Iowa State University, 1980-1984

Assistant Professor, Freshman Engineering, Iowa State University, 1979-1980

Instructor, Freshman Engineering, Iowa State University, 1977-1979

Temporary Instructor, Freshman Engineering, Iowa State University, 1976-1977

4. NONACADEMIC EXPERIENCE

Graduate Research Assistant, Ames Laboratory of the U.S. Atomic Energy Commission, Ames, IA, 1972-1974, half-time position

Assistant Metallurgist, Los Alamos Scientific Laboratory of the University of California, Los Alamos, NM 1972-1975, full-time position

5. CERTIFICATIONS AND PROFESSIONAL REGISTRATION

none

6. CURRENT MEMBERSHIPS IN PROFESSIONAL ORGANIZATIONS

World Gold Council, member

7. HONORS AND AWARDS

Excellence in Technology Transfer Award, Mid-Continent Region of the Federal Laboratory Consortium, 2010

James Huntington Ellis Award for Excellence in Teaching, ISU, 2006

Superior Engineering Teacher Award, ISU College of Engineering, 2000

U.S. Steel Foundation Fellow, U.S. Steel Foundation, Pittsburgh, PA, 1973-75

8. SERVICE ACTIVITIES

Reviews for Faculty Promotion Dossiers at The American University in Cairo, College of Engineering and the University of Missouri at Rolla, College of Engineering; Reviews for Technical Journals and Research Programs
Acta Materialia, Advanced Engineering Materials, Applied Physics Letters, Composites, Part A, Crystal Research and Technology, Current Applied Physics, Gold Bulletin, International Journal of Materials Research (formerly: Zeitschrift fuer Metallkunde), Journal of Alloys and Compounds, Journal of Materials Research, Journal of Materials Science, Journal of Phase Equilibria, Materials and Design, Materials Science & Engineering A, Metallurgical and Materials Transactions, Philosophical Magazine Letters, Surface and Coatings Technology, National Science Foundation, ***Strategic Environmental Research and Development Program***,
Smithsonian Institution, U.S. Civilian Research & Development Foundation, U.S. Civilian Research and Development Foundation (CRDF), U.S. Dept. of Energy,

9. MOST IMPORTANT PUBLICATIONS PAST FIVE YEARS

Cao G.H., Shechtman D., Wu D.M., Becker A.T., Chumbley L.S., Lograsso T.A., Russell A.M., and Gschneidner K.A., "Determination of slip systems and their relation to the high ductility and fracture toughness of B2 DyCu", Acta Materialia, Vol. 55, pp. 3765-3770 (2007)

Gschneidner, K.A., Ji, M., Wang, C.Z., Ho, K.M., Russell, A.M., Becker, A.T., and Larson, J.L., "Influence of the electronic structure on the ductile behavior of B2 CsCl-type AB intermetallics", Acta Materialia, Vol. 57, pp. 5876-5881 (2009)

Russell A. and Cook B., "Wear-resistant boride nanocomposite coating exhibits low friction", MRS Bulletin, Vol. 34, p. 792 (2009)

"A New Family of Al-alkaline Metal Composite Conductors", A.M. Russell and I.E. Anderson, EUCI (Electric Utility Consultants, Inc.) 2nd Annual High-voltage Transmission Conductor Conference, St. Louis, MO, September, 2010.

U.S. Patent pending, "Aluminum/Alkaline Earth Metal Composites And Method For Producing Same"; filed 2011

U.S. Patent 7,517,375, "Wear-resistant boride composites with high percentage of reinforcement phase"; issued 2009

U.S. Patent 7,238,429, "An Ultra-hard, Low Friction Coating Based on $AlMgB_{14}$ for Reduced Wear of MEMS and Other Tribological Components and Systems"; 2007.

10. RECENT PROFESSIONAL DEVELOPMENT ACTIVITIES

none

1. Name: Martha A. Selby

2. Education – M.S., Iowa State University, Business Administrative Sciences, 1988
   B.S., Metallurgical Engineering (with Distinction), Iowa State University, 1981

3. Academic experience –

1990-present	Adjunct Assistant Professor, Iowa State University, Ames, IA
1983-1990	Adjunct Instructor/Assistant to the Dean, Iowa State University, Ames, IA
1982	Tutor, Athletic Department, Iowa State University, Ames, IA

4. Non-academic experience –

1981-1982	Marketing Engineer, Olin Corp., E. Alton, IL
1980	Engr. Research Asst., Bethlehem Steel's Homer Research Lab, Bethlehem, PA
1979	Engr. Asst., Delavan Corp., W. Des Moines, IA

5. Certifications or professional registrations- none

6. Current membership in professional organizations- none

7. Honors and awards
   Akinc Excellence in Service Award, 2008
   Superior Engineering Advising Award, 2008
   Engineering Student Council Leadership Award, 2004
   Community Spirit Award, 2000
   Phi Kappa Phi, 1981
   Tau Beta Phi, 1980

8. Service activities (within and outside of the institution)
   Department: Curriculum Committee
   Honors, Awards and Scholarship Committee
   Governance Document Committee

   College: Academic Standards Committee
   Chair, Engineering Caucus of Faculty Senate (ended May 2011)
   Budget Planning Advisory Committee (ended May 2011)

   University: Chair, Senate Documents Committee (2011 – current)
   University Governance Committee(2011 – current)
   University Policy Advisory Library (2011 – current)
   Faculty Conduct Review Board (2010 – current)
   All University Judicial Review Board (2010 – current)
   University Committee to Review Student Grievances (2010 – current)
   Faculty Senator (ended May 2011)

Faculty Senate Executive Board (ended May 2011)
Faculty Senate Representative Committee (ended May 2011)
Faculty Senate Committee on Committee (ended May 2011)
Faculty Senate Spring Conference Committee (ended May 2011)
Faculty Senate FDAR Council (ended May 2011)

9. Briefly list the most important publications and presentations from the past five years –
   a) Edited Custom Published Text for Engr 160, 2011
   b) Reviewed numerous freshman engineering books and chapters
   c) Authored a professional paper which was accepted at the 1980 American Welding Society's National Convention

10. Briefly list the most recent professional development activities

1. Name: Dan Shechtman

2. Education –B.Sc. - Technion 1966, Mechanical Engineering.
   MSc. - Technion 1968, Materials Engineering.
   Ph.D. - Technion 1972, Materials Engineering.

3. Academic experience –

2006 – 3 months Visiting Distinguished Professor at Tohoku University, Sendai,Japan.
2004 - present Professor, Materials Science and Engineering, Iowa State University.
1998 - present Distinguished Professor of the Technion.
1997 – 2004 Visiting Professor, UMBC, Baltimore, Maryland.
1989 - 1997 Visiting Professor, Physics and Astronomy, The Johns Hopkins University, Baltimore, Maryland.
1986 - 1998 Professor, Department of Materials Engineering, Technion, Haifa
1984 - 1986 Associate Professor, Department of Materials Engineering, Haifa, Israel.
1981 - 1989 Visiting Professor, Department of Materials Engineering, The Johns Hopkins University, Baltimore, Maryland.
1977 - 1984 Senior Lecturer, Department of Materials Engineering Technion, Haifa, Israel.
1975 - 1977 Lecturer, Department of Materials Engineering, Technion, Haifa, Israel.
1972 - 1975 National Research Council, Post Doctoral Research Associate, Aerospace Research Laboratories, Wright Patterson AFB, Ohio.

4. Non-academic experience –

5. Certifications or professional registrations-

6. Current membership in professional organizations- Member, Israel Academy of Sciences (Chair of the Science Division 2001-2004) Member, National Academy of Engineering (USA) Member, European Academy of Sciences and Arts

7. Honors and awards

2011 Nobel Prize in Chemistry
2008 The EMRS (European Materials Research Society) award
2006 Elected Honorary Member of JIM (Japan Institute of Metals).
2004 Elected Member, European Academy of Sciences and Arts
2002 The EMETH Science Prize
2002 Honorary Doctorate, Ben-Gurion University of the Negev
2000 Elected Honorary member of the French Physical Society
2000 The Muriel & David Jacknow Technion Award for Excellence in Teaching
2000 Elected member of the American National Academy of Engineering.
2000 The Aminoff Prize of the Royal Swedish Academy of Sciences.
1999 The Wolf Prize in Physics.
1998 Elected Honorary Member of ISIS-Symmetry.

1998 Appointed a Distinguished Professor of the Technion.
1998 The Israel Prize in Physics.
1997 Elected Honorary Member of IMRS (Indian Materials Research Society).
1996 Elected member of the Israel Academy of Sciences.
1993 The Weizmann Science Award.
1990 The Rothschild Prize in Engineering.
1989 The Philip Tobias Chair.
1988 The New England Academic Award of the Technion.
1987 The International Award for New Materials of the American Physical Society.
1986 The Physics Award of the Friedenberg Fund for the Advancement of Science and Education.

8. Service activities (within and outside of the institution)

Israel Crystallography Society (Honorary Member).
Israel Society for Microscopy (Honorary Member)
ISIS-Symmetry -honorary Member (Honorary Member)
IMRS - Indian Materials Research society (Honorary Member)
IMS - Israel Metallurgical Society
Israel society of crystal growth
ASM - American Society for metals
JIM- Japan Institute of Metals (Honorary Member)

9. The most important publications and presentations from the past five years –

a. X. Gou and D. Shechtman, "Extruded High-Strength Solid Materials Based on Magnesium with Zinc, Yttrium and Cerium Additives", Glass Physics and Chemistry, Vol 31 No. 1, 2005, pp 44-52
b. X. Guo, J. Kinstler, L. Glazman and D. Shechtman, "High Strength Mg-Zn-Y-Ce-Zr Alloy Bars Prepared by RS and Extrusion Technology" Materials Science Forum vol. 488-489 (2005) pp. 495-498
c. I. Popov, D. Starosvetsky and D. Shechtman, "Initial Stages of Corrosion Within Mg-Zn-Y-Zr in 1 g/l NaCl Solution", Journal of Materials Science 38 (2000) 1-8
d. C.I. Lang, D.J. Sordelet, M.F. Besser, D. Shechtman, F.S. Biancaniello and E.J. Gonzalez, « Quasicrystalline Coatings: Thermal Evolution of Structure and Properties", J. mater. Res., vol. 15 No. 9, Sept. 2000

10. Briefly list the most recent professional development activities

1. Xiaoli Tan

2. Education

   B.E. in Metallic Materials, Xi'an Jiaotong Univ., Xi'an, P.R. China, 1989.
   Ph.D. in Materials Science and Engineering, Univ. of Illinois at Urbana-Champaign, 2002.

3. Academic experience

   Iowa State University, Associate Professor, 2008-present, full time.
   U.S.-DOE Ames Laboratory, Field Work Proposal leader, 2006-2009, part time.
   Technical University at Darmstadt, Germany, Guest Professor, 2008, part time.
   Iowa State University, Assistant Professor, 2002-2008, full time.

4. Non-academic experience: None.

5. Certifications or professional registrations: None.

6. Current membership in professional organizations
   The American Ceramic Society, since Jul. 1999.
   The Materials Research Society, since Jul. 2001.
   The Institute of Electrical and Electronics Engineers, since Dec. 2003.

7. Honors and awards

   2001 Phi Kappa Phi
   2004 NSF CAREER Award
   2007 MSE Excellence in Research Award, Mater. Sci. & Eng., ISU
   2007 Young Engineering Faculty Research Award, College of Engineering, ISU
   2008 Graduate student Xiaohui Zhao received MSE Rohit K. Trivedi Best Paper Award, ISU
   2008 ISU Award for Early Achievement in Research, ISU
   2010 *Journal of the American Ceramic Society* Associate Editor Recognition for outstanding contributions
   2011 IEEE Senior Member
   2011 Graduate student Cheng Ma received MSE Rohit K. Trivedi Best Paper Award, ISU
   2011 Graduate student Joshua Frederick was the winner of the ISU competition for the Midwestern Association of Graduate Schools Distinguished Master Thesis
   2011 *Journal of the American Ceramic Society* Associate Editor Recognition for outstanding contributions

8. Service activities (within and outside of the institution)

   08/02-05/08 Member of MSE department Graduate Study Committee
   2005 Spring Member of College of Engineering Graduate Scholarship Committee
   2005 Fall Member of MSE department Faculty Search Committee
   2006 Fall Member of MSE department Faculty Search Committee
   08/08-12/09 Chair of MSE department Seminar Committee

2009 Fall	Member of the Honors Committee at the College of Engineering
01/10-08/10	Member of MSE department undergraduate curriculum committee
08/10-05/11	Member of MSE department Faculty Search Committee
08/10-	Member of MSE department Graduate Study Committee
2006	Program Co-chair, the 15th IEEE ISAF, Sunset Beach, NC.
2011	Publications chair, the 20th IEEE ISAF, Vancouver, Canada.

9. Briefly list the most important publications and presentations from the past five years

X. Zhao, W. Qu, and X. Tan, "Zr-modified $Pb(Mg_{1/3}Nb_{2/3})O_3$ with long range cation order," *Journal of the American Ceramic Society* **91**, 3031-3038 (2008).

X. Tan, W. Jo, T. Granzow, J. Frederick, E. Aulbach, and J. Rödel, "Auxetic behavior under electrical loads in an induced ferroelectric phase," *Applied Physics Letters* **94**, 042909/1-3 (2009).

X. Zhao, W. Qu, X. Tan, A.A. Bokov, Z.-G. Ye, "Influence of long-range cation order on relaxor properties of doped $Pb(Mg_{1/3}Nb_{2/3})O_3$ ceramics," *Physical Review B* **79**, 144101/1-12 (2009).

X. Tan, J. Frederick, C. Ma, E. Aulbach, M. Marsilius, W. Hong, T. Granzow, W. Jo, and J. Rödel, "Electric-field-induced phase transition in mechanically confined antiferroelectric $Pb_{0.99}Nb_{0.02}[(Zr_{0.57}Sn_{0.43})_{0.94}Ti_{0.06}]_{0.98}O_3$," *Physical Review B* **81**, 014103/1-5 (2010).

C. Ma, X. Tan, E. Dul'kin, and M. Roth, "Domain structure–dielectric property relationship in lead-free $(1-x)(Bi_{1/2}Na_{1/2})TiO_3$-$x$$BaTiO_3$ ceramics," *Journal of Applied Physics* **108**, 104105/1-8 (2010).

X. Tan, J. Frederick, C. Ma, W. Jo, and **J. Rödel, "**Can electric field induce an antiferroelectric phase out of a ferroelectric phase?**" *Physical Review Letters* 105, 255702/1-4 (2010).**

E.A. Stefanescu, X. Tan, Z. Lin, N. Bowler, and M.R. Kessler, "Multifunctional fiberglass-reinforced PMMA-$BaTiO_3$ structural/dielectric composites," *Polymer* **52**, 2016-2024 (2011).

X. Tan, C. Ma, J. Frederick, S. Beckman, and K. Webber, "The antiferroelectric ↔ ferroelectric phase transition in lead-containing and lead-free perovskite ceramics," *Journal of the American Ceramic Society* **94**, 4091-4107 (2011).

M. Marsilius, J. Frederick, W. Hu, X. Tan, T. Granzow, and P. Han, "Mechanical confinement: An effective way of tuning properties of piezoelectric crystals," *Advanced Functional Materials* **22**, 797-802 (2012).

10. Briefly list the most recent professional development activities

Visited Xi'an Jiaotong University in China and Technical University at Darmstadt in Germany in Spring 2012 for the Faculty Professional Development Assignment.

1. Patricia A. Thiel

2. Education

B.A., Chemistry, Macalester College (1975).
Ph.D., Chemistry, California Institute of Technology (1980).
Postdoctoral Research: Ludwig-Maximillians-Universität München (1981).

3. Academic experience

Iowa State University, Assistant (1983-) to Associate (1988-) to Full (1991-present) Professor of Chemistry, part time. Chair (1999-2002).
Iowa State University, Full Professor of Materials Science and Engineering, part time — 10% of academic appointment with MSE, 90% with Chemistry (anticipated July 2012).

4. Non-academic experience

Control Data Corporation, Associate Scientist (1975-1976), full-time.
Sandia National Laboratory, Staff Scientist (1981-1983), full-time.
Ames Laboratory, Scientist (1983-present), part-time.
Ames Laboratory, Program Director for Materials Chemistry (1988-2004), part-time.
Ames Laboratory, Chief Research Officer (2008-2009), part-time.

5. Certifications or professional registrations. None.

6. Current membership in professional organizations.

Materials Research Society, Am. Physical Society, Am. Chemical Society, Am. Association for the Advancement of Science, Am. Vacuum Society.

7. Honors and awards

<u>National and international recognitions:</u>
David Adler Lectureship Award of the American Physical Society (2010).
Arthur W. Adamson Award of the American Chemical Society (2010).
Fellow: Materials Research Society (2012), Am. Association for the Advancement of Science (2011), Institute of Physics (2004), Am. Physical Society (2001), Am. Vacuum Society (2001).
Dr. Honoris Causa (honorary degree) - Institut National Polytechnic de Lorraine (2005).
National Honorary Member of Iota Sigma Pi (2008).
Department of Energy Award for Outstanding Scientific Accomplishment in Materials Chemistry, with 5 collaborators (1998).
NSF Faculty Award for Women in Science and Engineering (1991-1996).
Camille and Henry Dreyfus Teacher-Scholar (1986-1990).
NSF Presidential Young Investigator (1985-1989).
Alfred P. Sloan Foundation Fellowship (1984-1986).

<u>Local (ISU) recognitions:</u>
Master Teacher of the Liberal Arts and Sciences College (2010).
Institutional Service Award from the Liberal Arts and Sciences College (2010).

Distinguished Professor (2002).
Foundation Award for Outstanding Achievement in Research (1998).
Wilkinson Teaching Award in the Department of Chemistry (1996).

8. Service activities (within and outside of the institution)

At the national and international level, professional service has included panel review and award jury service; advisory committee service; organization of conferences, workshops, and sessions at conferences; service as administrative officer in professional societies; and membership on editorial boards of journals.

Organizations for which these services have been performed include funding agencies (NSF, DOE, NIH, ACS-PRF), professional societies (MRS, AVS, APS, ACS, AAAS), journals (Langmuir, Review of Scientific Instruments, Surface Science, Surface Science Reports, Journal of Vacuum Science and Technology, Journal of Physical Chemistry, Journal of Physics D: Applied Physics, Progress in Surface Science), and others.

Service within ISU and Ames Laboratory has consisted of much committee work.

9. Most important publications and presentations from the past five years

- Barış Ünal, V. Fournée, P.A. Thiel, and J.W. Evans, "Structure and growth of height-selected Ag islands on five-fold i-AlPdMn quasicrystalline surfaces: STM analysis and step dynamics modeling," *Physical Review Letters* **102**, 196103 (2009).
- T. Duguet, B. Ünal, J. Ledieu, J. M. Dubois, V. Fournée and P. A. Thiel, "Nanodomains due to phason defects at a quasicrystal surface," *Physical Review Letters*, **106**, 076101 (2011).
- T. Duguet, Y. Han, C. Yuen, D. Jing, B. Ünal, J.W. Evans and P.A. Thiel, "Self-Assembly of Metal Nanostructures and Thin Film Growth on Binary Alloy Surfaces," *Proceedings of the National Academy of Sciences* (invited), **108**, 989-994 (2011).
- J. Y. Park, D. F. Ogletree, M. Salmeron, C. J. Jenks, P. A. Thiel, J. Brenner, and J.M. Dubois, "Friction anisotropy: A unique and intrinsic property of decagonal quasicrystals," *J. Materials Research* **23** 1488-1493 (2008).
- P. A. Thiel, Mingmin Shen, Da-Jiang Liu, and James W. Evans, "Critical Review: Adsorbate-Enhanced Transport of Metals on Metal Surfaces: Oxygen and Sulfur on Coinage Metals," *J. Vacuum Science and Technology A* **28**, 1285 (2010).
- Jeong Y. Park and P. A. Thiel, "Atomic scale friction and adhesion properties of quasicrystal surfaces," *J. Physics: Condensed Matter* 20 314012 (2008).
- Yong Han, Baris Ünal, Dapeng Jing, P.A. Thiel, and J.W. Evans, "Temperature-dependent growth shapes of Ni nanoclusters on NiAl(110)," *Journal of Chemical Physics*, **135**, 084706 (2011).

10. Briefly list the most recent professional development activities. None.

1. Name: **Ersan ÜSTÜNDAG**

2. Education –
   1996- Cornell University, Ithaca, NY
   Ph.D., Materials Science and Engineering; Minor in Applied Mechanics
   1993- Cornell University, Ithaca, NY
   Master of Science, Materials Science and Engineering
   1990- Bogazici University, Istanbul, Turkey
   Bachelor of Science (with high honors), Mechanical Engineering

3. Academic experience –
   Department of Materials Science and Engineering, Iowa State University, Ames, IA *Associate Professor:* 2004 – Present, Materials Science Department, California Institute of Technology, Pasadena, CA *Assistant Professor:*1997 – 2004, Materials Science and Technology Division, Los Alamos National Laboratory, Los Alamos, NM *Post-Doctoral Fellow:*1995 – 1997, Department of Materials Science and Engineering, Cornell University, Ithaca, NY *Graduate Research Assistant* 1990 – 1995.

4. Non-academic experience -none

5. Certifications or professional registrations-none

6. Current membership in professional organizations –
   American Ceramic Society, Materials Research Society, TMS: The Minerals, Metals and Materials Society.

7. Honors and awards –
   - Glen Murphy Chair of Engineering, Iowa State University, 2004-present.
   - Member of the Advanced Photon Source Scientific Program Advisory Comm., 2004-05.
   - Keynote speaker, 7th Inter. Conference on Residual Stress (ICRS-7), Xian, China, 2004.
   - Keynote speaker, MECA SENS II, 2nd International Conference on Stress Evaluation by Neutron and Synchrotron Radiation, Manchester, England, 2003.
   - National Science Foundation CAREER Award, 2000-2004.
   - Charles Lee Powell Award, California Institute of Technology, 2000-2002.
   - Visiting Scientist, 1997-present, Los Alamos National Laboratory.
   - Director-Funded Post-Doctoral Fellowship, 1995-1997, Los Alamos National Lab.
   - Teaching Fellow, 1993, College of Engineering, Cornell University.
   - McMullen Graduate Fellow, 1991-1992, Cornell University.

8. Service activities (within Iowa State University) –

2008-Present: Member of strategic planning and graduate study committees

2008-2009: Member of cyber infrastructure committee

2007-2009: Lockheed-Martin interdisciplinary design project committee, Coll. of Eng.

2007-2008: Member of the faculty search committee

2005-2008: Member of the seminar committee

2005-2006: Chair of the seminar committee

2005-2006: Member of the strategic planning committee

2005-2006: Member of the faculty search committee in electronic materials

2004-2005: Member of the graduate study committee

9. The most important publications and presentations from the past five years
    a. G. Tütüncü, S. M. Motahari, M. R. Daymond and E. Üstündag, "A Modified Rietveld Method to Model Highly Anisotropic Ceramics," ***Acta Mater***. 60 [4], 1494-1502 (2012).
    b. M. Varlioglu, U. Lienert, J. S. Park, J. L. Jones and E. Üstündag, "Thermal and Electric-Field Dependent Evolution of Domain Structures in Polycrystalline $BaTiO_3$ using the 3D-XRD Technique," ***Texture, Stress, and Microstructure***, vol. 2010, Article ID 910793, 2010.
    c. M. Varlioglu, E. Üstündag, N. Tamura and J. L. Jones, "Evolution of Ferroelectric Domain Structures Embedded Inside Polycrystalline $BaTiO_3$ during Heating*,"* ***J. Appl. Phys***.107, 064101 (2010).
    d. Martin Kunz, Nobumichi Tamura, Kai Chen, Alastair A. MacDowell, Richard S. Celestre, Matthew M. Church, Sirine Fakra, Edward E. Domning, James M. Glossinger, Dave W. Plate, Brian V. Smith, Tony Warwick, Howard A. Padmore and Ersan Ustundag, "A dedicated superbend x-ray microdiffraction beamline for materials-, geo- and environmental sciences at the Advanced Light Source," ***Rev. Sci. Instrum***. 80, 035108 (2009).
    e. J. L. Jones, S. M. Motahari, M. Varlioglu, U. Lienert, J. V. Bernier, M. Hoffman and E. Üstündag, "Crack Tip Process Zone Domain Switching in a Soft Lead Zirconate Titanate Ceramic," ***Acta Mater***. 55, 5538-5548 (2007).
    f. J. L. Jones, A. Pramanick, J. C. Nino, S. M. Motahari, E. Üstündag, M. R. Daymond and E. Oliver, "Time-resolved and orientation-dependent electric-field-induced strains in lead zirconate titanate ceramics," ***Appl. Phys. Lett***. 90 [17], 172909 (2007).
    g. J. L. Jones, J. E. Daniels, and E. Üstündag, "Advances in the Characterization of Domain Switching in Ferroelectric Ceramics," ***Z. Krist. Suppl***. 26, 441-446 (2007).
    h. S. Y. Lee, E. Üstündag, J. D. Almer, U. Lienert and W. L. Johnson, "Pseudo-Binary Phase Diagram for Zr-based In-Situ □ Phase Composites," ***J. Mater. Res.*** 22 (2), 538-543 (2007).
10. Briefly list the most recent professional development activities

Appendix C – Equipment

Please list the major pieces of equipment used by the program in support of instruction.

The number in parentheses indicates multiple copies when applicable.

1. UV Spectrometer Shimadzu
2. FTIR Spectrophotometer Shimadzu
3. Thermolyne 46100 Furnace
4. Thermolyne 46200 Furnace
5. Thermolyne 54500 Furnace
6. Thermolyne 6000 Furnace
7. Thermolyne 30400 Furnace
8. Thermolyne 79400 Furnace
9. Thermolyne 59300 Furnace
10. Duo-Vac Oven
11. Rockwell FR-3E Hardness Tester (2)
12. Macromet 3100 Hardness Tester
13. AMH43 Micro-Hardness Indenter (2)
14. SZX-10 Research Stereo Microscope
15. LX-31 Inverted Metallurgical Microscope (10)
16. Leco SS-1000 Grinder and Polisher (4)
17. UC-200 Ultrasonic Cleaner (2)
18. Leco MSX-250 Sectioning Machine
19. Leco PR-32 Mounting Press (4)
20. DSC Pyris 1 Perkin Elmer
21. TGA 7 Perkin Elmer
22. TMA 7 Perkin Elmer
23. DMA 7e Perkin Elmer
24. TG/DTA 320 Seiko
25. Charpy impact tester Tinius-Olsen
26. Instron 4204 Mechanical Testing Unit
27. Instron 3367 Mechanical Testing Unit
28. Scanning Electron Microscope JEOL
29. Scanning Electron Microscope ASPEX
30. X-ray Diffractometer Scintag
31. X-ray Diffractometer Rigaku
32. Mechanical Tester Shimadzu
33. roller Mill
34. spex mill
35. vibratory mill

36. Rheometers (4)
37. Injection Molding Units (2)

Appendix D – Institutional Summary

Programs are requested to provide the following information.

1. **The Institution**
   a. Name and address of the institution

      Iowa State University of Science and Technology
      Ames, Iowa 50011

   b. Name and title of the chief executive officer of the institution

      Dr. Steven Leath, President

   c. Name and title of the person submitting the self-study report.

      Lawrence J. Genalo, University Professor and Associate Chair for Undergraduate Education and Administration

   d. Name the organizations by which the institution is now accredited and the dates of the initial and most recent accreditation evaluations.

      Iowa State University is accredited by the Higher Learning Commission, a commission of the North Central Association of Colleges and Schools. Iowa State has been continuously accredited since 1916. The most recent accreditation was in 2006. The next accreditation review will be in 2016.

2. **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

   Iowa State University is a public institution of the State of Iowa. It is managed by the Iowa Board of Regents.

3. **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.

4. 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.

Table D.4-1. Academic Support Units

Academic Support Units		
Unit	**Name**	**Title**
Aerospace Engineering and Engineering Mechanics	Richard Wlezien	Professor and Coffman Chair
Electrical and Computer Engineering	David Jiles	Distinguished Professor and Chair
Materials Science and Engineering	Richard LeSar	Gleason Professor of Interdisciplinary Engineering and Chair
English	Barbara Ching	Professor and Chair
Library	Olivia Madison	Professor and Dean
Mathematics	Wolfgang Kleimann	Professor and Chair
Chemistry	William Jenks	Professor and Chair
Physics	Joseph Shinar	Professor and Chair

5. 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.

Table D.5-1. Non-academic Support Units

Non-academic Support Units		
Unit	**Chair**	**Title**
Learning Communities	Doug Gruenewald	Co-Director
Center for Excellence in Learning & Teaching	Ann Marie VanDerZanden	Director
Library	Olivia Madison	Dean
ISU Information	Jim Davis	Vice Provost/CIO

Technology		
Engineering Career Services	Brian Larson	Program Director
Student Success Center	James Dorsett	Interim Dean of Students
Engineering Student Services	Joel Johnson	Program Manager I
Engineering Information Technology	Jason Shuck	Systems Analayst II
Engineering-LAS Online Learning	Tom Brumm	Professor-in-charge

6. Credit Unit

One semester credit represents one class hour or three laboratory hours per week. The fall and spring semesters are each 16 weeks long and include a week for final examinations. Thus one academic year is 30 weeks of classes.

7. Tables

Complete the following tables for the program undergoing evaluation.

Table D-1. Program Enrollment and Degree Data

Name of the Program: Materials Engineering

	Academic Year		Enrollment Year 1st	2nd	3rd	4th	5th	Total Undergrad	Total Grad	Degrees Awarded Associates	Bachelors	Master of Engineering	Master of Science	Doctorates
Current		FT	28	42	29	69		168		—		—	—	—
		PT	0	0	1	7		8			38			
Year	F11	Total	28	42	30	76		176						
1		FT	34	33	46	54		167		—		—	—	—
		PT			1	2		3			27			
	F10	Total	34	33	47	56		170						
2		FT	25	35	44	52		156		—		—	—	—
		PT			2	8		10			47			
	F09	Total	25	35	46	60		166						
3		FT	30	42	40	43		155		—		—	—	—
		PT			1	12		13			33			
	F08	Total	30	42	41	55		168						
4		FT	33	34	37	43		147		—		—	—	—
		PT			3	5		8			32			
	F07	Total	33	34	40	48		155						

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

Name of the Program: Material Engineering

Year[1]: Fall 2011

	HEAD COUNT		FTE[2]
	FT	PT	
Administrative[3]	3		1.1
Faculty (tenure-track)	20	2	21.25
Other Faculty (excluding student Assistants)	7	1	6.5
Student Teaching Assistants		3	1.5
Student Research Assistants		59	58.25
Technicians/Specialists	1	1	1.25
Office/Clerical Employees	5	0	5
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.