DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

2009-2010

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IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

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Materials Science & Engineering
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Dear Undergraduate Student:

On behalf of our faculty, staff, and students, I welcome you to our department. You have selected a field that is exciting, demanding, and rewarding. The opportunities and challenges for materials science and engineering graduates are almost endless. Preparing you for these challenges will demand a great deal of effort from you. We are anxious to assist you so that your experience during your undergraduate education is a productive and enjoyable one.

We are very glad you joined our department. Please do not hesitate to contact me or the Associate Chair, Larry Genalo, or any other member of the faculty for assistance during your tenure in this department.

Wishing you a successful college experience,

Sincerely,

Richard LeSar, Chair
Department of Materials
Science and Engineering

I. INTRODUCTION

This booklet has been prepared to help you become acquainted with the personnel, facilities and operations of the Department of Materials Science and Engineering (MSE) of Iowa State University. We hope that it will also provide a starting point in your search for information concerning important activities and procedures with which you will become involved. We hasten to note that the booklet is far from all-inclusive and we realize that it is not "the last word" on all the matters with which it deals. It is intended to supplement other valuable sources of information such as the Iowa State University Bulletin (catalog), The Student Information Handbook, The Iowa State Daily, The Department Bulletin Board, on-line resources and special announcements issued by the departmental and college offices. Certainly, some of the most valuable sources of information available are people, assuming you can find the proper ones. Therefore, another objective for this booklet is to provide some detail concerning the identification and location of individuals who can, and quite happily will, be of help to you in a variety of important areas.

We hope you will read the MSE Undergraduate Handbook now, refer to it frequently throughout the coming semesters, and let us know how it might be changed to serve you and future students more effectively. You can also access the MSE Undergraduate Handbook online - http://www.mse.iastate.edu/students/4-year-program-summary.html under the heading “Courses”.

Please accept our best wishes for a successful year as well as for a rewarding academic and professional career.

II. THE DEPARTMENT OF MATERIALS SCIENCE & ENGINEERING

The MSE Department was formed in 1975 by the merger of the previously existing Departments of Ceramic Engineering and Metallurgy. MSE is one of eight degree-granting departments in the College of Engineering.

The Departmental Office is located in Room 2220 Hoover Hall. At that location you can find the Department Chair, Dr. Richard LeSar, many departmental faculty, an academic advisor, and members of the departmental secretarial staff (APPENDIX H & I). These individuals are anxious to help you in any way possible and you will probably notice the need to interact with them frequently for a variety of reasons.

Several departmental bulletin boards with important student and department information are also located inside the departmental office.

II.A. The Materials Engineering Curriculum

The MSE Department administers the undergraduate curriculum in Materials Engineering. At the undergraduate level, within this degree program, you must select a minimum of two areas of specialization from the following: ceramic, metallic, electronic, and polymeric materials. Beginning with the 2007-09 catalog you may propose your own materials-related second specialty. The specific rules for the proposal-based specialization are on page 19. You do not have to make this selection until your junior year. More detailed information about the specializations will be presented elsewhere in this booklet. (See APPENDIX B for the complete undergraduate curriculum. A descriptive list of all courses offered by the MSE Department can be found in APPENDIX C.) Although you will of course be most concerned with your own specialization areas, it will be advantageous for you to learn as much as possible about the entire materials field. You will certainly want to try to interact with many of the students and faculty members of our Department.

You may also be interested in knowing that the MSE Department offers MS and PhD degrees in Materials Science and Engineering. You may also want to read Section III.H on the concurrent BS/Graduate Study program. We invite your consideration of our excellent opportunities for graduate study at an appropriate future time.

II.B. The MSE Faculty

Obviously one of the most important elements in any Department is its faculty, and we have good reason to be extremely proud of ours. Its members are nationally- and internationally-known experts in their fields. Furthermore, they are adept in transmitting their knowledge and the benefits of their experiences to their students through formal and informal interactions. The names, academic backgrounds, and technical interests of the faculty are given in APPENDIX G. You should feel completely free to contact any faculty member to discuss academic or career matters. A directory of MSE faculty is listed in APPENDIX H.

II.C. The Advising System

Your advisor is a person with whom you will have extremely important interactions while you're at Iowa State. You may have, by now, met your advisor and should seize every opportunity to become better acquainted with this person. The goal of the department advising system is to assist students in the development of an academic program that meets students' career objectives as well as specific curriculum requirements. The advisor interprets the rules and requirements of the university as well as the college and department, so a student can make informed decisions about their programs.

Listed in APPENDIX A are the individuals who are advising undergraduate students. You may find the list especially useful if you should ever need help with a problem while your own advisor is unavailable. Also included in this list are the names, office addresses, and phone numbers of the support staff who may be able to assist you. Should you ever be unable to contact your advisor directly, just inform the appropriate staff member of your need to arrange for an appointment and the message will be promptly relayed.

Please keep your advisor, as well as the department secretary, informed of any address, phone number, or other changes, as this is essential to keeping an open line of communication. Students are also able to update address information with the University very easily and quickly. This can be done by using the address change function available on the Web through AccessPlus. Especially important is that your advisor knows your e-mail address and that you check your e-mail frequently for important messages both from your advisor and from the department.

If any problem, either academic or personal, cannot be resolved by your advisor or if you cannot make contact with that person or an alternate quickly enough, the Department Chair or Assistant Department Chair will be happy to be of assistance. You are encouraged to visit with both the Chair and Asst. Chair at any time, even when there are no problems.

II.D. Teaching Facilities and Safety Policy

An attractive feature of our department is the small class sizes that make instruction more interactive. In addition, our curriculum includes a large number of laboratory courses that provide hands-on education to students. Generally, the classrooms and teaching laboratories for the department are located in Hoover Hall. Our current laboratories contain all items of equipment and experimental facilities that are necessary to teach the physical concepts and illustrate the important processing operations involving materials.

Specific instructions regarding procedure and technique will be given to the enrollees of each laboratory course. Also, information will be made available concerning the specific precautions, which must be taken in the conduct of the various laboratory operations. In general, students must pursue their laboratory coursework in a safe, scientific, and professional manner.

Safety of all students, faculty, staff, and visitors is of utmost concern. The responsibility for your personal safety while engaged in the academic pursuits of the Department can never rest solely with the instructor or staff. It is your co-responsibility to become familiar with the safety provisions within the geographic confines of the Department. In general, the major hazards encountered in lectures and/or laboratory periods include high temperatures, dangerous chemicals, and ionizing radiation. Ask your instructor for information regarding safety provisions and emergency procedures. The use and location of tongs, protective gloves, special explosion-proof storage units for flammable chemicals, chemical sinks, fume hoods, eye-wash fountains, body showers, and monitors for ionizing radiation should be discussed at the beginning of the semester. If the instructor does not include this information, then you should insist on it. In the absence of all information, the minimum approach should be that you do not attempt ANY even remotely hazardous operation when you are alone. Ask someone to be on guard. Above all, plan your work in advance and use common sense.

II.E. MSE Student Room Facilities

The MSE department maintains an excellent computer and study facility for the use of MSE undergraduate students. The student room (~700 sq. ft.), located in 3337 Hoover Hall, houses PC compatibles and the software needed for MSE homework and laboratory assignments. There are also a number of peripheral devices including laser (B&W and color) printers and scanners. These computers are all networked to the college file server as well as to the Internet. There are also a number of valuable reference resources and texts.

The student room also has tables and chairs for group work. Students often find themselves meeting in the student room to work on homework and labs together. The student room is accessible 24 hours/day with a coded ID card. (See the departmental secretary for access.) Hoover Hall, however, is locked after hours. Building hours are currently Monday through Saturday 6 a.m. to midnight, and Sunday 7 a.m. to midnight. The computer lab is maintained by the department systems support specialist, Josh Klesel. Therefore, if you have questions, problems, or concerns, please contact Josh by email at jklesel@iastate.edu or by phone at 515-294-3504.

II.F. Special Study and Work Opportunities

The Department offers opportunities for undergraduates to become involved in timely and significant materials research problems. Many aspects of the Department's research activities are open to student participation via special topics courses. If you are interested, contact your advisor or the staff member with whom you would like to work. Both academic credit and valuable experience can be gained.

Another quite fruitful source of information on materials research and the current activities of materials scientists is the departmental seminar series. Presentations are offered by off-campus speakers as well as by staff members and graduate students from

MSE and other ISU departments. Although the series is of primary interest to persons involved in research, you are most welcome and will often find the subject pertinent to your course work or expected professional involvement. Announcements of the seminars are posted on fliers that are put on various bulletin boards throughout the Department; they are also sent via email.

There are a significant number of opportunities for undergraduate majors in the materials disciplines to secure part-time employment as research or teaching helpers through the MSE Department. If you wish to be considered for these, you should make your interests known to the Assistant Chair.

II.G. Co-Op/Internships

Industrial positions as co-op students (3 work terms alternating with class) and internships (either semester or summer) are often available to students and provide valuable experience. If you are interested in these programs, see the co-op/internship advisor listed in APPENDIX A.

II.H. International Exchange Programs

The MSE department currently has an agreement with the materials engineering department at Brunel University, United Kingdom, to develop a program of academic exchange for faculty and students. The agreement provides an opportunity to support international relations of exchange activities.

There is also a summer program, usually taken after the freshmen year, at Brunel that includes a 3 credit US Diversity course and a 3 credit introductory material course (Mat E 391 and Mat E 392). Mat E 215L (1 credit) in the following fall will complete the substitution requirements for Mat E 215/215L. In addition the International Perspectives requirement will be met.

There are also a number of opportunities to study abroad in exchange programs that are available to all College of Engineering students. Some of the countries where our students have studied include Switzerland, Turkey, Singapore, and Australia to name a few. More information may be found with the Engineering College's International Programs Office located in 116 Marston Hall or by contacting them directly at 515-294-9295, by email at eip@iastate.edu, or visit their website at http://www.eng.iastate.edu/intlprogs/.

III. ACADEMIC MATTERS

The MSE Department offers an undergraduate curriculum in Materials Engineering. This area of study leads to the Bachelor of Science degree. There is significant flexibility in the program allowing you to shape it to your own needs and goals.

The curriculum sheet in APPENDIX B will illustrate the nature of the course selection and planning with which you will be involved throughout your undergraduate career. While they are fairly typical plans, they should not be thought of as the only type of program that can be arranged.

The next several paragraphs present in some detail areas that directly affect you and your progress toward the BS degree.

III.A. Academic Progress

Each semester brings a set of deadlines for completing a number of essential activities. The schedule of important dates for the current academic year is presented in APPENDIX D. You are urged to be alert to possible changes in the schedule and to announcements containing additional information of this type as the academic year progresses. These elements of new information will be conveyed by means of notices placed on a bulletin board in the main office in Hoover Hall, postings in the computer lab, and sometimes in e-mails from your advisor or administrative staff. One of the best references is the Academic Calendar page on the ISU web-site – www.iastate.edu/~registrar/calendar/.

As you might expect, the University goes to great lengths to keep track of your academic progress. At the end of each semester a grade report slip will be posted on your record and you can view it using Access Plus. On it are noted the courses for which you were registered, as well as the grades you achieved.

In the MSE Department the advisors use the appropriate curriculum sheet (APPENDIX B) to note grades achieved as well as to plan future semesters.

Your academic progress is also reflected on a single-sheet form known as the ISU Advisement/Degree Audit. Two copies of this form are printed for each student and are distributed to your academic advisor shortly before registration each semester.

III.B. Program Objectives and Outcomes

The Materials Engineering Curriculum has been designed to provide you with experiences to develop the knowledge and skills required to serve the profession. The program objectives are shown below:

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. respond to environmental, social, political, ethical and economic constraints to improve the quality of life in Iowa and the world
c. work independently and in teams and are proficient in written, oral and graphical communication
d. engage in lifelong learning in response to the rapidly expanding knowledge base and changing environment of our world
e. engage in advanced study in materials and related or complementary fields

Educational Outcomes

Engineering programs must demonstrate that their graduates have

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.

Additional Materials-Specific Outcomes; Graduates of the program must have demonstrated:

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.

Additional Materials-Specific Outcomes specified for ISU/MSE; graduates have…

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

III.C. Choosing Areas of Specialization

You must choose your two areas of specialization from the following: ceramic, electronic, polymeric, metallic materials or a materials-related specialty that you can propose for approval (see page 19). You may also choose to use your technical electives to pursue a third area. If you choose to invest more time in your education, you could potentially choose to take courses in all four specializations. The choice of specializations can be made any time prior to your first semester junior year. The materials courses you will take during your sophomore year will expose you to all areas of materials, providing information on which to base your decision. Please inform your advisor as soon as you have chosen your areas of specialization. You may change at any time, but be aware that if you change AFTER you begin your specialization sequence, the change could delay your graduation. Many students choose to take entry level courses for three areas with the intent of using the "extra" course as a technical elective. This strategy allows you to delve deeper into the topic before making a decision.

III.D. Requirements for Graduation

In order to earn a B.S. in Materials Engineering, you must earn a minimum GPA of 2.0 in the following core courses.

Mat E 215/215L/216	Mat E 316	Mat E 418
Mat E 214	Mat E 317	
Mat E 311	Mat E 413	
Mat E 314	Mat E 414	

*Plus your six specialization courses (three courses from each of your two official areas of specialization).

The use of a 490 course from any department (Mat E 490 included) to substitute for a required Mat E course is highly discouraged and is only allowed with prior approval by the MSE Undergraduate Curriculum Committee. Such approval will require the student to submit a proposal to the committee, in advance, explaining why it is impossible to take the required course itself and how the proposed 490 will be assured (by the student and the instructor) to be equivalent to the Mat E course for which it is being substituted.

III.E. 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 courses: Eng 302, 309, 314, JLMC 347.

III.F. Departmentally Approved Electives

This program requires 15 credits of General Education electives (see section E.2), and 3 credits of free electives (see section E.3). University requirements are that 3 credits of these be from an approved list for U.S. Diversity and 3 credits be from an approved list for International Perspectives (APPENDIX F). An approved study or work abroad program of sufficient length will substitute for the International Perspectives requirement, and the 3 credits can be taken elsewhere. It is most important for elective courses to be well coordinated and to complement your particular career objectives. Additionally, students must have a six-credit area of emphasis within the Gen Ed courses.

The program also requires six credits of Technical Electives (see Appendix C.1).

III.G. Pass/ Not Pass Grading

Students may take up to 9 semester credit hours of General Education or free electives on a pass-not pass basis meaning that only a S (satisfactory or pass) or F (fail or not pass) will be recorded as their final grade in the course. However, those courses meeting U.S. Diversity and International Perspectives requirements may NOT be taken P/NP. The purpose of P/NP grading is to encourage students to take courses more challenging than their usual program of study. You must have earned at least 40 semester credits to take a course P/NP, and may not be on temporary enrollment. Only General Education elective or free elective courses may be taken P/NP. Students should discuss this option with their advisor.

The free elective credits can be any non-remedial University course you choose. [Examples of remedial classes include Chem 105, Math 140, Math 141, Math 142, and English 101].

III.H. Scholarships

The Department maintains an outstanding scholarship program for its majors. Also, many general scholarships open to students in all disciplines of the College of Engineering are available to students in our department.

In recent years, MSE students have received scholarships ranging from $500-$5000.

To apply for any of the scholarships offered by the Department or the College a student MUST complete the College of **Engineering** Scholarship application (which is available online). **The deadline is around February 1st each year.** Email notifications will be sent out concerning the application deadline. Selection recommendations for all scholarships are prepared by departmental and college committees. Scholarship recipients are named and honored at the annual MSE Spring Banquet.

III.I. Concurrent BS/Graduate Study Program in MSE

The following is a brief description of the MSE Department's concurrent BS/Graduate Study program and requirements. This information is also available on the MSE website at http://www.mse.iastate.edu.

The Department of Materials Science and Engineering can admit seniors with exceptional academic qualifications into the program for "Concurrent Enrollment for Graduate/Undergraduate Degrees." A student in this program pursues a graduate MS or PhD degree while simultaneously completing his/her undergraduate BS degree. After successfully completing the requirements for the BS and graduate degree, the student will receive both degrees at graduation – typically, but not always, on the same graduation date.

Students seeking admission to this program will apply near the end of their junior undergraduate year and are encouraged to discuss the matter with their academic advisor, the Director of Graduate Education (DOGE), or with the Department Chair. An information packet is also available from the MSE Graduate Coordinator in the main MSE Office, 2220 Hoover Hall.

Qualifications include the following:
Minimum overall GPA of 3.5
Minimum 90 credits accrued to begin BS/Graduate Study Program
Major Professor must be identified

In brief summary, the following steps should be taken to apply for the BS/Graduate Study program: (please obtain items 3, 5, 6, 7, on-line at http://www.grad-college.iastate.edu/forms/forms.html)

1. Identify an MSE faculty member willing to serve as your Major Professor.
2. Obtain a written recommendation from your undergraduate advisor.
3. Complete an on-line graduate application that includes the following items – ISU Grad College Application Form, Full Resume/Curriculum Vitae, GRE General Test Scores, three letters of recommendation, personal statement of purpose and research interests, and form 1-A regarding transcripts and scholastic standing.

The following items (4-7) should be completed with the necessary signatures obtained, and then submitted to the MSE graduate coordinator, Krista Briley, in the main MSE Office, 2220 Hoover Hall.

4. MSE Department BS/Graduate Study Program of Study (POS) form (available from the MSE graduate coordinator)
5. Concurrent Enrollment Request form (must be submitted in order for application to be complete)

Forms to complete once graduate admission is approved:

6. Recommendation for Committee Appointment form
7. Program of Study (POS) form

Admission/Assistantship
No decision will be made on admission until all application material is complete and submitted. BS/Graduate Study students are under the same guidelines for review as all other students who apply through the graduate application process.

Students in the BS/Graduate Study program are eligible for research assistantships offered directly through MSE faculty members with research contracts (this would be the major professor that you have identified in your application); however, such assistantships are contingent upon availability of funding and are not guaranteed for all concurrent BS/Graduate Study students. Students are eligible for a ¼-time assistantship upon entrance into the BS/Graduate Study program. Students who have accrued enough applicable credits to be eligible for B.S. graduation are eligible for ½-time assistantship. A completed and approved MSE Department BS/Graduate Study Program of Study will be used to identify the semester that the transition from ¼-time to ½-time will take place. However, this is not automatic – written documentation from the student's undergraduate academic advisor stating the minimum BS requirements have been met AND the increase/additional funding meets the approval of the major professor is required. Once received and approved, appropriate action will be taken to apply the increase. In addition, all students on assistantship are eligible for in-state resident tuition.

Coursework
Students may double-count up to six credits between their B.S. and graduate degree requirements. However, courses may **only** be used in this manner when they are taken <u>after</u> the date when the student becomes a concurrent BS/Graduate Study student.

III.J. Student Organizations

We are fortunate to have several very active student organizations in which our majors can participate. (See APPENDIX J.) Student professional societies and clubs for materials majors include the following:

Material Advantage (program of the combined ACerS, ASM, TMS)
Keramos – National Professional Ceramic Engineering Fraternity
Gaffer's Guild – Glass Blowing Club

Material Advantage is a membership option for students who want to get more out of their materials engineering experience. It provides access to the materials science and engineering profession's most outstanding societies: American Society of Materials (ASM), The Materials Society (TMS), and the American Ceramic Society (ACerS). Our chapter is a joint chapter of all three. The organization's national website can be visited at http://www.materialadvantage.org/. It was named outstanding chapter in the nation the last five years.

Keramos is a National Professional Ceramic Engineering Fraternity. One of the main functions of Keramos is to promote and emphasize scholarship and character in the thoughts of students in Ceramics and to promote interest in the professional aspects of ceramic engineering, technology, and science. ISU's chapter strives to recognize students with outstanding academic achievement and encourage interaction between students and alumni. Students are selected to become a member of this honorary organization. More information can be obtained through the ACerS national website under membership classes at http://www.ceramics.org/membership/classes.asp.

Gaffer's Guild is the artistic glass blowing club at Iowa State University. The club is a unique organization -- membership is open to all students and members of the community. They provide educational sessions where you can learn to blow glass. There are specific guidelines for becoming a gaffer. For more information visit their website: http://gaffer.stuorg.iastate.edu/.

You probably have been, or soon will be, contacted by a person from one or more of these organizations. That person would be very pleased to discuss the activities and membership procedures with you. If you have not been so contacted, please do not hesitate to get in touch with the organizational representatives and let your interests be known. The names of the current officers and faculty advisors for these groups are listed in APPENDIX J. The benefits, both immediate and long-term, from active participation in these organizations cannot be overemphasized. Included among the dividends are: the chance to become better acquainted with other students and the staff members in the department, some very excellent insight regarding the nature of your field, an early and continuing exposure to the practical and applied aspects of the materials disciplines through field trips and attendance at national or regional meetings, and finally, beneficial contact with practicing engineers. These organizations also provide their members with effective mechanisms for interacting with departmental operations and administration. The comparatively minor amount of time and effort that any of these organizations require will be very well spent, and each one of you is encouraged to consider becoming actively involved.

III.K. Interviewing and Placement

Although the specific timetable adopted varies with each individual's situation, it is generally true that during the senior year the student will arrange several campus and on-site interviews with potential employers. The Engineering Career Services Office holds annual orientation meetings for seniors, which constitute a valuable opportunity for becoming familiar with this important process. It is advisable to be registered with the Career Services Office as early as your freshman year as co-op, internship, and summer opportunities often exist. Also, the Placement Officer and associates are willing to provide assistance and guidance whenever it is needed. The Engineering Career Services website (http://www.eng.iastate.edu/ecs/) is a good source for information.

Information regarding the schedule of campus interview visits that are planned by industrial representatives and descriptions of specific openings are available on-line at the Engineering Career Services website. In addition to these placement announcements, job opportunities are also posted on the departmental bulletin board just outside the student computer room.

In this regard there is excellent wisdom in maintaining your up-to-date address and current status in the MSE department file. On occasion word of a vacant position is received and contact with you would be useful.

IV. CONCLUSION

We hope that the information presented in this MSE Handbook has helped to answer some of your questions. At the very least, we hope that this information has pointed you in the right direction. We invite your constructive criticism for future editions.

Once more, we wish you every success in all of your activities while you are at Iowa State and after you depart. We stand ready to help you achieve success in any way we possibly can.

UNDERGRADUATE ADVISOR

NAME	OFFICE	PHONE	E-MAIL
Andrea Klocke	2220R Hoover	4-0891	aklocke@iastate.edu

CO-OP/INTERNSHIP ADVISOR

NAME	OFFICE	PHONE	E-MAIL
Andrea Klocke	2220R Hoover	4-0891	aklocke@iastate.edu

HONORS PROGRAM CONTACT

NAME	OFFICE	PHONE	E-MAIL
Scott Chumbley	2220Q Hoover	4-1435	chumbley@iastate.edu

UNDERGRADUATE CURRICULUM CHAIR

NAME	OFFICE	PHONE	E-MAIL
Larry Genalo	2220A Hoover	4-4722	genalo@iastate.edu

UNDERGRADUATE SUPPORT STAFF

NAME	OFFICE	PHONE	E-MAIL
Melissa Skinner	2220 Hoover	4-1214	skinnerm@iastate.edu

Curriculum in Materials Engineering

2009-2011 Catalog

Total credits required: 127.5

Freshman Year					
Semester 1	15.5 cr	Year taken	***Semester 2***	17 cr	Year taken
Math 165	4 cr		Math 166	4 cr	
Engr 160	3 cr		Engr 170	3 cr	
Engr 101	R cr		Chem 178	3 cr	
English 150	3 cr		Chem 178L	1 cr	
Chem 177	4 cr		Gen Ed: _____	3 cr	
Chem 177L	1 cr		Gen Ed: _____	3 cr	
Lib 160	0.5 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	18 cr	Year taken	***Semester 6***	15 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		Gen Ed: _____	3 cr	
Gen Ed: _____	3 cr		*(International Perspectives)*		
(U.S. Diversity)					
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)		

Specialization Course Sequences

(*Note*: F = offered Fall only, S = offered S 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 332 (F or S)	Mat E 443 (F)	Mat E 453 (F)
Mat E 425 (F)	Mat E 433 (F)	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.

APPENDIX B.2

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 "course of study" justifying the choice of each course as well as a statement concerning the overall purpose of the proposed specialization. This proposal should be 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 to 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, 170, Math 165, 166, 267, MatE 215, 215L, Phys 221, Chem 177/177L, 178, 178L (or equivalents)
   c. A grade of B+ or better must have been earned in MatE 215, 215L
2. A completed approval form, which includes permissions from the students Mat 215/215L instructors, academic advisor, and at least one other faculty member.
3. The proposal must include a complete proposed "program of study" for all remaining semesters.

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. Two courses (6 cr) must be at the 300+ level.
   b. One course (3 cr) must be at the 400+ level.
   c. At least two courses must come from any engineering department, physics, chemistry, math or the life sciences.
   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 opinion 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 1 of the 4 specializations

TECHNICAL ELECTIVES

Guidelines for Technical Electives in Materials Science and Engineering:

Materials Science is a diverse field and there are many options for appropriate technical electives. Most fall in the following categories, though if you find an elective that you feel is appropriate, but is not on this list, please consult with your advisor.

1. Any 300 or 400 level Math, Physical or Life Sciences, or Engineering course not in Materials Engineering.
2. Any graduate level course in Math, Physical or Life Sciences, or Engineering, including Materials Science and Engineering.
3. Any 300 or 400 level Materials Engineering course not required for your Mat E degree.
   (exception: students may not use Mat E 490 toward this requirement unless prior approval is granted by the MSE Undergraduate Curriculum Committee)
4. A 490 course in any department is not allowed unless prior approval is granted by the MSE Undergraduate Curriculum committee.

FREE ELECTIVES ACCEPTABLE FOR MATERIALS ENGINEERING CURRICULA

Materials Engineering students are required to take 3 credits of "free" electives. A free elective can be any non-remedial course. (For example, Mat E students take Math 165 as the first required math course. Any lower math course is considered remedial.)

The following is a partial list of courses that would be considered remedial: any course at a level lower than 100; Math 104, 105, 140, 141, or 142, Chem155, 160, 163 or 164, Phys 101, 106, 111, or 112.

Math 104	Chem 155	Phys 106
Math 105	Chem 160	Phys 111
Math 140	Chem 163	Phys 112
Math 141	Chem 164	Stat 1XX
Math 142	Phys 101	Com S 103

GENERAL EDUCATION (GEN ED) ELECTIVES ACCEPTABLE FOR MATERIALS ENGINEERING CURRICULA

Materials engineering students are encouraged to select Gen Ed courses that broaden their academic program. Courses in the social sciences (sociology, anthropology, journalism and mass communication, economics, political science, human development and family studies, psychology) or humanities (architecture, literature, foreign language, music, philosophy, religion, history) are especially encouraged. Please see listing on next page.

All materials engineering majors must take 15 credits of Gen Ed courses. Within the 15 credits, students must have a **6-credit area of emphasis**. The courses used to create the area of emphasis do not have to be in the same department (e.g. Phil 235 Ethical Issues in a Diverse Society and Mgmt 472 Management of Diversity). The university requirements for U.S. Diversity and International Perspectives must be met, and can be met through the courses selected in the Gen Ed requirement.

Any university course may be selected for Gen Ed requirements except:

1. The course may not be remedial.
2. The course may not be offered in engineering, the physical sciences, computer science, or mathematics.
3. The course may not be one that could have counted as a technical elective (e.g. a 300 level life science may not be used for Gen Ed, but a 200 level can be used).
4. No more than 9 credits in 100-level courses
5. No more than 9 credits may be taken from any one department
6. No “skills” courses (such as PE classes in golf, pool, etc. or music courses in playing an instrument or participating in band, choir, etc.)

APPENDIX D

Social Sciences and Humanities/General Education Courses Accepted by Engineering

2007-2009 Catalog

African American Studies (AF AM) **201**[1] American Indian Studies (AM IN) **210**[1], **310**[1] Anthropology (ANTHR) 201[2], 306[2], 308, 309[2], 313[1,2], 322[1], 323[2], 325[2], 326[2], **337**[2], 340[2], 411[2], 412[1], 439[2], 444[2] Architecture (ARCH) **221**[2], **222**[2], **420**[1], **422**[2], **423**[2], **424, 425, 427**[2] Art History (ART H), **280**[2], **281**[2], **382**[2], **383, 385, 394**[1], **481**[2], **495**[1] Classical Studies (CL ST) **273**[2], **275**[2], **353**[2], **372**[2], **373**[2], **374**[2],**376**[2], **394**[2], **402, 403, 404** Community and Regional Planning (C R P) 253, 270[1] Economics (ECON) 101, 102, 301, 302, **312**, 320, 321[1], 355[2], 370[2], 380, 385[2] English (ENGL) **201, 230**[2], **231, 237, 301, 335, 340**[1], **344**[1], **345**[1], **346**[1], **347**[1], **348**[1], **349**[1], **353**[2], **354**[2], **358, 360, 362, 364, 366, 370**[2], **373, 374**[2], **375**[2], **376**[2], **378, 384, 389**[2], **420, 422**[1] Foreign Languages and Literature (F LNG) **All** except F Lng 486, 487, 490, 491, 493, 497, 499 **(102**[2], **201**[2], **202**[2] **any foreign language)** (Software Engr does not accept lang courses) Greenlee School of Journalism and Communication (JL MC) 474[2], 476[2], **477**[1]	History (HIST) **All** except 490, 495 **(i.e. 201**[2], **202**[2], **207**[2], **221, 222, 240**[1], **280**[2], **281**[2], **323**[2], **336**[2], **337**[2], **341**[2], **389**[2], **390**[2], **421**[2], **422**[2], **424**[2], **473**[1]**)** Human Development and Family Studies (HD FS) 102, 239[1], **240**[1], 276[1], 349[1], 377[1], 448[1] Music (MUSIC) **102**[2], **383**[2], **384**[2], **471**[2],**472**[1], **473, 475** Philosophy (PHIL) **All** except 206, 207, 490, 492 **(235**[1], **338**[1]) Political Science (POL S) All except 101, 298, 301, 417, 430, 475, 476, 486, 490, 495, 498, 499 (i.e. 215, 241[2], 251[2], 341[2], 349[2], 350[2], 385[1,2], 452[2]) Psychology (PSYCH) 101, 230, 280, 360 Religious Studies (RELIG) **All** except 340, 490, 491, 499 **(205**[2], **210**[1], **233**[1,2], **242**[2], **323**[2], **328**[1], **334**[1], **336**[1], **338**[1,2], **352**[2], **353**[2], **356**[2], **376**[2]**)** Sociology (SOC) 134, 219, 235[1], 241, 264, 305, 310, 325, 327[1], 328[1], 330[1], 331[1], 332[1], 340, 345[2], 380, 381, 382, 411[2], 415, 420, 431[1], 435, 485 Technology and Social Change (T SC) 341 Women's Studies (W S) **201**[1], 203[1], **301**[2], **350**[1]

Notes: [1]*Indicates course meets "U.S. Diversity Requirement"*
[2]*Indicates course meets "International Perspectives Requirement"*
*Courses listed in **bold** are humanities; courses listed in plain type are social sciences*

Visit the following website to view a complete list of courses that have been approved to meet the U.S. Diversity and International Perspectives requirements: www.iastate.edu/~registrar/courses/div-ip-guide.html.

International Perspectives Course List: **http://www.iastate.edu/~registrar/courses/ip-list.html**

U.S. Diversity Course List: **http://www.iastate.edu/~registrar/courses/diversity-list.html**

THE MSE FACULTY AND RESEARCH INTERESTS

PROFESSOR

Mufit Akinc Professor Ph.D., Iowa State University	Ceramic processing; solid-liquid and solid gas interactions in ceramic systems.
L. Scott Chumbley Ph.D., University of Illinois	Electron microscopy of in-situ composites; high temperature oxide superconductors; forming and ductility of inter-metallic compounds; rapid solidification processing.
Larry Genalo University Professor and Associate Chair Ph.D., Iowa State University	Computer usage in the classroom - Authorware & web-based lessons and tutorials; High-tech learning environments - computers, VCRs, etc. attached to a projector; mobile robots as a technology learning tool; Improving the engineering pipeline for women, minorities, and disabled; K-12 interaction with ISU.
Brian Gleeson Professor Ph.D., University of California Los Angeles	High-temperature corrosion behavior of multi-phase materials; (aqueous corrosion) advanced coatings; diffusion and thermodynamic treatments of gas/metal and solid/solid interactions; structure; property relationships of materials.
Karl A. Gschneidner, Jr. Distinguished Professor Ph.D., Iowa State University	Physical metallurgy of rare earths; alloy theory and phase formation studies; solid state physics.
Alexander King Professor, Ames Lab Director Ph.D, University of Oxford, U.K.	Transmission electron microscopy; Scanning electron microscopy; theory of defects in solids; Interfaces; Diffusion-induced grain boundary migration
Richard LeSar Professor & Chair Ph.D., Harvard University	Modeling and simulation of materials; dislocation plasticity, biopolymers.

Valery Levitas Professor Ph.D., University of Hannover, Germany	Stress-and-strain-induced phase transformations; high pressure mechanics and mechanochemistry; structural changes in materials via virtual melting; multiscale modeling; strain-induced chemical reactions; large inelastic deformation of solids; continuum thermodynamics and kinetics; instabilities in materials and structures; micromechanics and nanomechanics; energetic nanoenergetic materials; superhard materials; smart materials
Surya Mallapragada Ph.D., Purdue University	Nanomanipulation of semicrystalline polymer surfaces; semicrystalline polymer drying; controlled drug delivery.

PROFESSOR

Steve W. Martin Distinguished Professor Ph.D., Purdue University	Glass formation, structure, properties and dynamics; Ionic transport: dependence on glass microstructure and chemistry; Relaxations in glass: electrical, magnetic, mechanical and thermal stresses probed by Impedance and NMR Spectroscopies, Brillouin Light Scattering and Scanning Calorimetry; The liquid - Glass transition; Chemical restructuring processes in liquids and glasses.
Vitalij Pecharsky Distinguished Professor Ph.D., Lviv State University, Lviv, Ukraine	Experimental thermodynamics, physical properties of binary, ternary, and multicomponent intermetallic compounds. Structure-property relationships. Advanced magnetic materials. Hydrogen storage alloys.
Krishna Rajan Stanley Chair in Interdisciplinary Engr. Sc.D, Massachusetts Institute of Technology	Materials informatics and combinatorial materials science; high resolution electron microscopy & nanostructural characterization of materials; microstructural evolution in materials; information technology applications in materials science
Alan Russell Ph.D., Iowa State University	In-situ strengthened titanium, aluminum, ar magnesium composites; thermophotovoltaic emitt materials; ultra-rapid quenching of actinide alloys
Danny Shechtman Ph.D., The Technion	Quasi-periodic crystals; metallic multilayers; phase transition; rapid solidification of metallic alloys, and the structure and properties of CVD diamond wafers.

Patricia A. Thiel Distinguished Professor Ph.D., California Institute of Technology	Creating simple model surfaces and studying their chemistry on an atomic scale; use single crystal surfaces with known morphology; fundamental and applied surface chemistry including metal thin films and quasicrystals.
R. Bruce Thompson Distinguished Professor Director, Ctr. for Nondestructive Eval. Ph.D., Stanford University	Nondestructive evaluation techniques; ultrasonic and magnetic techniques for characterizing discrete flaws, failure and related microstructural properties, and stresses.

PROFESSOR

Rohit K. Trivedi Distinguished Professor Ph.D., Carnegie University of Technology	Structure and properties of metallic surfaces; growth mechanisms and morphologies of second phase particles.

ASSOCIATE PROFESSOR

Ashraf Bastawros Ph.D., Brown University	Mechanical properties of materials; Advanced characterization methods.
Nicola Bowler Ph.D., University of Surrey, U.K.	Thickness of case-hardened layers in steel components using eddy current and alternating current potential drop (ACPD) methods; modeling dielectric properties of two- and three-phase composite materials; effect of curing on the dielectric properties of composite materials at microwave frequencies.
Kristen Constant Ph.D., Northwestern University	Computer-aided instruction; photonic band gap materials; processing of ceramics for electrical, thermal, and chemical applications.
Ralph E. Napolitano Ph.D., Georgia Institute of Technology	Modeling and control of solidification microstructures. Defect formation and prediction in single-crystal castings. Dendritic array character and stability. Laser processing and spray forming.
Xiaoli Tan Ph.D., University of Illinois at Urbana-Champaign	In-situ TEM study of electrically active ceramics; Ferroelectric thin films; Piezoelectric single crystals and ceramics; Deformation and fracture of metal thin films; Failure analysis of devices and components; Microwave processing.

Ersan Ustundag Glenn Murphy Professor of Engineering Ph.D., Cornell University	Constitutive behavior of advanced materials; application & development of advanced neutron and X-ray scattering techniques in materials research; micromechanics of composite materials; mechanical behavior of and internal stresses in bulk metallic glasses and their composites; internal stresses and constitutive behavior of electroceramics; thin film mechanics; mechanical behavior of composites in extreme environments; solid state reactions & phase transformations as related to internal stress evolution

ASSISTANT PROFESSOR

Scott Beckman Ph.D., University of California, Berkeley	Defects in semiconductors and nano-structures; ferroelectric crystals, films, and nano-structures; techniques for the study of material design
Sumit Chaudhary Ph.D., University of California, Riverside	Materials for renewable energy; Nanomaterials and nanotechnology; Electronic, magnetic, and photonic materials.
Wei Hong Ph.D., Harvard University	Mechanics of soft active materials; modeling and simulation; fracture, deformation and mass transport; evolving microstructure of materials; continuum mechanics and computational methods; biomechanics
Michael Kessler Ph.D., University of Illinois	Mechanics and processing of polymer matrix composites; biologically inspired materials; experimental solid mechanics and fracture; thermal analysis of polymers
Zhiqun Lin Ph.D., Univ. of Massachusetts	Hierarchical structure formation and assemblies via solvent evaporation; thermodynamics and kinetics of polymer dispersed liquid crystal; quantum dot-conjugated polymer assembly
Martha Selby M.S., Iowa State University	Educational research: multimedia courseware, innovative presentation techniques, and computer literacy.

SENIOR LECTURER

Alan Constant Ph.D., Northwestern University	Electronic materials
Michael "Hogan" Martin Ph.D., Cornell University	Materials education

MATERIALS ANALYSIS RESEARCH LABORATORY (MARL)

Jerry Amenson Manager Engr. Research Lab, Adjunct Instructor	Materials analysis and characterization
Scott Schlorholtz Scientist, Adjunct Asst. Professor	Materials analysis and characterization
Warren Straszheim Associate Scientist	Materials analysis and characterization

ADJUNCT PROFESSOR

Iver E. Anderson Ph.D., University of Wisconsin	Powder metallurgy & rapid solidification; development of high pressure gas atomization for production of fine metal powders; fine components; permanent magnets & high Tc superconductors.

ADJUNCT PROFESSOR

R. William McCallum Ph.D., University of California	Magnetic & electronic properties of ternary rare earth compounds; high temperature superconductors; permanent magnetic materials; effect of microstructure on superconducting & magnetic properties; fabrication of high Tc superconducting wire.

ADJUNCT ASSOCIATE PROFESSOR

Krishna Athreya Ph.D., Iowa State University	Engineering leadership.
S. Bulent Biner Ph.D., Aston University Birmingham/England	Modeling and simulation of mechanical behavior of engineering materials by analytical and computational techniques. Mechanics and mechanisms of deformation, fracture, fatigue and industrial forming process.

Matt Kramer Ph.D., Iowa State University	Electron microscopic characterization (analytical and transmission) of metals, minerals and ceramics Experimental, numerical, and theoretical analysis o deformed ceramics, intermetallics, quasicrystals an minerals. Materials processing of intermetallics an high temperature ceramic superconductors.

PROFESSOR EMERITUS

William Larsen Ph.D., Ohio State University	Metallurgical engineering design and failure analysis; corrosion and oxidation; industrial and legal applications of metallurgy.
David M. Martin Ph.D., Iowa State University	Properties of glasses; fiber glass mechanics; properties of ceramic surfaces, electron beam instruments.
Thomas D. McGee Ph.D., Iowa State University	Glass structure and properties; mechanical properties in ceramic systems; studies involving ceramic refractories and bioceramics.
John W. Patterson Ph.D., Ohio State University	Internal oxidation and diffusion studies of solid electrolytes; mixed conduction in ionic compounds; solid state electrochemistry.
John F. Smith Ph.D., Iowa State University	Bonding interactions and thermodynamic properties of metals; relationships between structure and physical properties; prediction of phase equilibria from thermodynamic data.
John D. Verhoeven Distinguished Professor Ph.D., University of Michigan	Diffusion and mass transport in liquid metals; metal solidification studies; preparation of composite materials by directional phase transformations.
Monroe Wechsler Ph.D., Columbia University	Radiation effects of metals and alloys; nuclear materials research; phase transformation studies.
David R. Wilder Ph.D., Iowa State University	Phase equilibria, sintering and reaction kinetics in rare earth oxides.

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APPENDIX F

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UNDERGRADUATE ORGANIZATIONS

2009-2010

KERAMOS

PRESIDENT ..... Kathryn Schlichting
VICE PRESIDENT ..... Erik Manatt
SECRETARY ..... Mary Burroughs
TREASURER ..... Seth Berbano
HERALD ..... Zach Royer
E-COUNCIL .....
FACULTY ADVISOR ..... Mufit Akinc

MATERIAL ADVANTAGE (ACerS, ASM, and TMS combined)

PRESIDENT ..... Emily Kuster
VICE PRESIDENT (Fundraising & Programming) Greg Vetterick
TREASURER ..... Ryan Gebhardt
SECRETARY ..... Brad Williams
EVENTS CHAIR ..... Barry King
PROGRAMMING CHAIR ..... Amy Bergerud
OUTREACH CHAIR ..... Tim Cleveland
FUNDRAISING CO-CHAIRS ..... Kate Lindley and Tim Pearson
HISTORIAN…….. Megan Lamb
FACULTY ADVISOR ..... .Scott Chumbley

GAFFERS GUILD (Glass Blowing Club)

PRESIDENT ..... Bill Lawaupt
VICE PRESIDENT ..... Tyler Johnson
TREASURER ..... John O'Brian
SECRETARY ..... Chelsea Clinton
FACULTY ADVISOR ..... Steve Martin