

SELF-STUDY QUESTIONNAIRE

FOR REVIEW OF

ENGINEERING PROGRAMS

FINAL EDITION

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

Submitted by

UNIVERSITY OF MISSOURI-ST. LOUIS/WASHINGTON UNIVERSITY
JOINT UNDERGRADUATE ENGINEERING PROGRAM

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Engineering Accreditation Commission
Accreditation Board for Engineering and Technology

Program Self-Study Report

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Program Self-Study Report for Bachelor of Science in Mechanical Engineering

A. Background Information

1. Degree Titles: Bachelor of Science in Mechanical Engineering
2. Program Modes

This particular degree is part of a special program set up jointly between the University of Missouri, St. Louis, and Washington University in St. Louis. The program was begun in 1993 as an engineering track in the University of Missouri System which would give an opportunity for nontraditional students to enter the Engineering Profession. Thus, all of the students in this program are, by definition, part-time students. They typically have full-time day jobs and take their university courses in the evenings, usually only one or two courses per semester.

The first two years of studies are taken entirely at the University of Missouri Campus in St. Louis. However, many students transfer to that campus from Junior Colleges in the area, so that their freshman and sophomore courses may come from a mixture of venues. In all, they take all of their non-engineering courses, including Calculus and Differential Equations, in the University of Missouri System. They, consequently, take all Humanities and Social Studies there. Thirdly, they take some pre-engineering courses in the U of M system (or transfer them from Junior Colleges). These include drafting, statics, and dynamics.

Then, all engineering courses beyond this are taken at Washington University in St. Louis. Officially, the UMSL students sign up for engineering classes within the University of Missouri System and ultimately receive a University of Missouri Degree. However, all of their engineering courses are actually taken at Washington University in St. Louis and are given at our facilities by our faculty and adjunct faculty. What we have done is virtually to clone our fully accredited day school program for the UMSL students. All courses, topics studied, and labs are identical to our own courses except for the course number. In fact, under special circumstances, we sometimes merge the UMSL and WU sections into a single course with one instructor but with both our students and their students in the class.

In order to maintain this parallelism, whenever an UMSL course is being taught by an affiliate faculty, we designate a full-time Washington University Mechanical Engineering faculty member to be the course master for the course, work with the adjunct on course content, and make sure that sufficient ABET collection is done. Because the regular WU program is virtually identical to the UMSL program, we utilize the assessment process in our WU program to give feedback into the UMSL sections, and vice versa. Therefore, in this report, one will see references to assessment mechanisms from both programs being used to improve the curriculum in both programs.

3. Actions to Correct Previous Deficiencies

We applied for accreditation for the first time in June of 2001 with a visit in the Fall of 2001. The result of that visit was that, although there were no deficiencies in the program (and it was accredited), there were deemed to be deficiencies in our self study report such that the evaluators felt unable to pre-review the program completely based on the self-study documentation. As a result, we were required to submit an interim report which we did in January 2004. This interim report was deemed adequate, and accreditation was continued.

B. Accreditation Summary

Criterion 1. Students.

Students are accepted into this program in a multi-phase process. First, they must be admitted into the University of Missouri system on the same basis that any other student would be admitted, based on high school (or previous college) GPA, SAT's, etc. If they choose the pre-engineering program, then they take the Math, Physics, Chemistry, and Statics/Dynamics in that program. Since the University Missouri System includes the University of Missouri at Rolla and the University of Missouri at Columbia, and the University of Missouri at Kansas (each of which has an accredited Mechanical Engineering Program), all of these undergraduate courses must (by State law) be acceptable for transfer into those other schools' Engineering Curricula. Therefore, since they are accepted by those schools, we also accept them.

For courses outside of the University of Missouri system and transferred in from Junior Colleges, we use the same transfer requirements that we use for transfer students into our own, Washington University, program. Through the years, we have evaluated transcripts from a great many universities and colleges in the country. The results of these analyses are now in a computer data base which automatically checks past transcripts and computes which of our courses the corresponding transferred course would count towards. If a college is not in our data base, we ask for syllabus, course description, and examples of work so that we can then enter it appropriately. As in our regular program, no grade below a C is ever transferred.

In terms of advising, each student has a pre-engineering advisor within the UMSL system that guide the students to make sure they have taken the appropriate courses that will allow them to enter the engineering program on schedule. Once they are admitted to the engineering program, a WU advisor is given to each student. We have four advisors of these students: David Peters, the chairman of ME; Richard Gardner, the Assistant Chair and lead person in the UMSL program; Prof. Ken Jerina; and Prof. Phil Bayly. These four have the primary advising roles for the upper level engineering courses. During this past year, we have augmented the above advising process by hiring an adjunct faculty, Prof. Carl Bagget, as the lead UMSL advisor. We are currently in the process of transitioning all UMSL student files over to him. He has an office on the WU campus and is constantly available by phone and email to the students.

Each semester, during the period specified for preregistration, individual students meet with their advisors to plan course selections for the following semester and to register for them. At this time the student's progress is evaluated. For undergraduate students this evaluation process is facilitated by the following records provided by the Engineering Registrar:

1. a "Transcript" printout which lists the student's course work semester by semester;
2. a "Degree Audit" printout which the advisor and Dean use to analyze the student's completed credits against several specific categories that must be satisfied for graduation. These are:
 - (i) *Residency requirement*: a minimum of 30 units of upper level engineering courses.
 - (ii) *Required core courses* in chemistry, mathematics and physics.
 - (iii) *Breadth requirement*: at least four engineering courses outside of mechanical engineering.
 - (iv) *Humanities and social sciences*: minimum of 18 units, suitably distributed, with concentration.
 - (v) *Engineering courses* prescribed for major.
 - (vi) *Technical electives*: 12 units upper level engineering.
 - (vii) *Engineering Topics units* accumulated: minimum of $\frac{3}{8}$ of program, 48 units.

Prerequisites are controlled by the advisors who are well aware of them and, if in doubt, can refer to the specific course descriptions in the School's *Course Schedule* directory as well as the university catalog. The course descriptions list prerequisites explicitly.

Substitutions for required courses occur rarely but can be permitted if in the advisor's judgment the proposed substitute course is essentially equivalent in content and at the same or higher level.

As described above, each student's progress is tracked semester by semester by means of the "Degree Audit." When the student is within one year of graduation the Dean and advisor perform a graduation check for all degree requirements.

Criterion 2. Program Educational Objectives

The basic purpose of the undergraduate program is to prepare the students either for professional practice in a traditionally broad and growing spectrum of industrial mechanical engineering activity or for entry into graduate school. This means, at minimum, the provision of a firm scientifically-grounded foundation in all four of the major stems of modern mechanical engineering, viz., mechanisms and mechanical design, dynamics and control, fluid mechanics and thermal science, and mechanics and materials science. At

Washington University this is accomplished through introductory courses in design and manufacturing at the Freshman and Sophomore levels followed by almost exclusively engineering courses in the Junior and Senior years. We have the philosophy of giving every student a broad, Mechanical Engineering Education, so every student must take courses in every stem.

Today the design of mechanical systems is intimately entwined with electrical circuits and controls. The curriculum aims to prepare the mechanical engineering graduate for this reality by requiring one course in introductory control systems (JME 4310) and six credits of electrical engineering: JEE 2300, "Introduction to Electrical Network," plus one course from a menu of four courses: JEE 2330 (electrical/electronics laboratory), JEE 2320 (linear and digital electronics), JEE 3320 (power systems) and JEE 3300 (engineering electromagnetic fundamentals).

Above all, the education delivered by this program must be an adequate platform for continuing education and professional development. The learning that future practicing engineers must do in order to survive will be done primarily in an independent, active mode rather than the passive, classroom mode. To this end the curriculum incorporates a strong engineering science base (including 8 units of Physics and 8 units of Chemistry) and a comprehensive 4-unit course in applied mathematics beyond calculus and differential equations. With these intellectual tools, the graduate is enabled to read and digest the research literature and to analyze conceptual designs before pursuing their development of new products and processes.

We make the following definitions in accordance with ABET EC2000 standard use:

Program Outcomes: Statements that describe what the students are expected to know and be able to do at the time of graduation.

Program Educational Objectives: Statements that describe the expected accomplishments of graduates during the first few years following graduation.

In addition, we define Course Goals as "Statements which describe what topics, material, ideas and concepts are to be covered in a particular course," and Course Outcomes as "Statements which describe the learned information, skills and knowledge a student obtains by taking the course." It should be emphasized that these terms are not independent. A Course Goal when learned by the student becomes a Course Outcome. The sum of all Course Outcomes becomes the **Program Outcomes**, and the successful application of a **Program Outcome** in the work place becomes a completed **Program Educational Objective**.

With the above philosophy in mind, we have listed the following ten objectives as the key focus of our program:

Mechanical Engineering Program Educational Objectives

1. Apply fundamental scientific and engineering concepts involving Dynamics and Systems, Material Science, Mechanics and Solids and the Thermal-Fluid Sciences in order to identify, formulate and solve a variety of mechanical engineering problems.
2. Design, modify, conduct and analyze experiments in the areas of thermal-fluid sciences, solid mechanics and dynamical systems.
3. Directly perform system, process and component selection in order to satisfy specific engineering-related needs through the application of mechanical design philosophy in engineering practice.
4. Communicate in oral and written presentations using graphic and/or visual media appropriate for an engineering business environment.
5. Operate productively in individual or multidisciplinary, team-oriented projects.
6. Be exposed to modern developments, products and tools as they relate to engineering practice.
7. Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards.
8. Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts.
9. Recognize the need for (and obtain the tools necessary to engage in) life-long learning.
10. Be afforded the opportunities to participate in cooperative education, internships, research experiences or international exchange programs in order to gain experience beyond the classroom.

Objective #10 above is realized through the office of Student Services at Washington University (which is also available to our Joint Program students). Students can obtain CO-OP positions and summer intern positions, they can interview with companies that come to campus, they can attend resume-writing sessions and polish their people skills in dealing with future employers. That objective is in our public documents because it is an important activity on our program which is supported by both universities.

These goals and objectives can now be compared with the Mission Statements of The University of Missouri St. Louis and of Washington University:

Mission Statement, UMSL

“Academic programs are enriched through advanced technologies and partnerships that link UM-St. Louis to institutions and businesses locally, regionally, nationally, and internationally. Its special commitment to partnership provides UM-St. Louis with a leadership role among public educational and cultural institutions in improving the region’s quality of life, while its relations with two-and four-year colleges and universities in the St. Louis region promote seamless educational opportunities.”

As one of the four campuses comprising the University of Missouri, the University of Missouri-St. Louis has served the citizens of the St. Louis metropolitan area since 1963. It shares the university's land-grant tradition and is committed to research and public service. The productive scholars on the campus's faculty contribute significantly to the theoretical and applied research in their fields. The campus's business, chemistry, political science, and metropolitan studies programs already are internationally recognized. As it develops, the campus will support other centers of excellence in departments or clusters of departments as the quality of scholarship achieves consistent international recognition. In addition to its role to advance knowledge as part of a comprehensive research university, the University of Missouri-St. Louis has a special mission determined by its urban location and its shared land-grant tradition. It works in partnership with other key community institutions to help the St. Louis region progress and prosper. Through its seven schools and colleges, the campus provides opportunities for all the people of the metropolitan area, including the economically disadvantaged, to receive high quality and accessible liberal arts, career, professional, and graduate education. Through a careful melding of strengths in scholarly research, teaching, and community service, the University of Missouri-St. Louis plays a leadership role in advancing scholarship; providing quality undergraduate, graduate, and professional instruction to the large and diverse numbers of students in the St. Louis area, while it contributes to economic development throughout the state and region. In shaping and evaluating its undergraduate curriculum, the University of Missouri-St. Louis fosters intellectual independence, sound judgment, clarity of expression in writing, aesthetic refinement, and sharpened analytical skills. The campus provides high quality undergraduate, graduate, and professional instruction to an ethnically, racially, and economically diverse student body. Special efforts are made to fulfill the university's land-grant mandate to serve the working people of the state. Because most of the campus's graduates remain in the metropolitan area, they enhance the economic development and quality of life of the metropolitan area and the state. These research, instructional, economic development and community service missions are accomplished by on-campus and extension programs in the schools and colleges of Arts and Sciences, Business, Education, Nursing, and Optometry, as well as the Evening College and the Division of Continuing Education-Extension. In addition, the campus's humanities, fine arts, and performing arts programs enrich the cultural life of the metropolitan area.

Mission Statement, Washington University:

"Washington University's educational mission is the promotion of learning--learning by students and by faculty. Teaching, or the transmission of knowledge, is central to our mission, as is research, or the creation of new knowledge. The faculty, composed of scholars, scientists, artists, and members of the learned professions, serves society by teaching; by adding to the store of human art, understanding, and wisdom; and by providing direct services, such as health care."

"Central to our mission are our goals, which are to foster excellence in our teaching, research, scholarship, and service; to prepare students with the attitudes, skills, and habits of lifelong learning and with leadership skills, enabling them to be useful members of a global

society; and to be an exemplary institution in our home community of St. Louis, as well as in the nation and in the world.”

"Through our goals Washington University intends to judge itself by the most demanding standards; to attract people of great ability from all types of backgrounds; to encourage faculty and students to be bold, independent, and creative thinkers; and to provide the infrastructure to support teaching, research, scholarship, and service for the current and for future generations."

The parts of the Washington University Mission Statement that deal with the transmission of knowledge and the infrastructure necessary to support engineering activities, generate the need to teach the fundamental items of mechanical science. This leads to Objectives 1 – 3. The concept of being of service to future generations implies the communication skills inherent in Objectives 4 – 6. The Washington University Mission Statement lines concerning useful members of society and to be exemplary, lead to Objectives 7 – 8. The above statement about life-long learning is the impetus for Objectives 9 and 10. Thus, our Educational Objectives flow from the Washington University Mission Statement.

Part of the University of Missouri Mission Statement is to serve the citizens of the St. Louis Area. This is done through the Joint Program because it is a part-time program for local, non-traditional students. It should be noted that this Joint Program is virtually a clone of our regular Washington University program. Thus, the Educational Objectives are the same for these programs.

Program Constituency

The principal constituency of the program is, of course, the student body and their parents. Second, we have the companies that come to Washington University and recruit our students as well as graduate schools that admit our students to advanced-degree programs. Third, the faculty are a constituency of the program since they are concerned about the effectiveness of the program. Fourth, alumni of the program are also a constituency and can contribute a perspective on the program. The Joint Program is in some ways unique in the close-knit relationship with the local community in that students are both working in local industry and looking for employment in local industry. Thus, potential employers within a 100-mile radius are the strongest part of the industrial constituency whereas the WU students tend to take jobs all over the country.

Establishment and Review of Objectives

The Program Objectives were set up over an evolutionary process of about four years. First, Dean Byrnes convened all of the Department Chairmen and others involved in the program to talk about ABET EC2000 and about the need to establish a long-range plan for accreditation of both our Day-School and our Joint Programs under ABET EC2000. At this point, we began to develop our mission statements and objectives for the various programs.

Next, in Mechanical Engineering, our MAE faculty met and discussed these objectives in a MAE retreat held in the Fall of 1999. The National Council of the WU School of Engineering was also convened, and we asked them for their input as to the adequacy of these objectives. Stanley Proctor, a member of our National Council, was also the president of ABET for one year during their transition to ABET EC2000; and his aid was invaluable to us. In the Spring of 2000, Mechanical Engineering convened the WU Undergraduate Advisory Board and asked them for their opinions on these objectives. The objectives were sent to the members ahead of time so they could study them before the meeting. Those who could not attend emailed in their comments. As a result of student inputs, the several objectives were modified to indicate constituent concern.

Next, the UMSL Student Advisory Board for the Joint ME Program also met. These students had a slightly different perspective than our full-time students and offered further refinement to the objectives. Furthermore, since the UMSL program is a clone of our regular program, the input from that advisory board also affects our regular program. Our ME External Advisory Board convened. Finally, those faculty specifically involved in teaching and in being course masters for the Joint Program were asked to look at the objectives and to give input. Appendices I-D, I-F, and I-G describe some of the details of these assessment procedures.

Based on all of these inputs, the Mechanical Engineering Educational Objectives were formulated as stated previously. Since then, we have continued to review these objectives appropriately as inputs are received from the various constituents. The constituents have been identified as the faculty, students, employers of graduates, and alumni of the program. Discussion and feedback from any of the four groups causes the development of Educational Objectives to be a continuous and evolving process. The objectives are included in the Engineering Bulletin. Students who matriculate into the program are given a copy of the Engineering Bulletin and are advised to keep it as the “legal” document that has the detailed requirements they must satisfy for their chosen program. Each semester, the students who attend the engineering orientation meeting receive the same document from the Bulletin. Both the External Advisory Board (comprised of Engineering Professionals) and the Student Advisory Board (comprised of current MAE students in the program) have the Program Objectives put on the table for discussion as they meet each year. The faculty, of course, are the ones who created the initial list of Program Objectives; and they review them periodically in the forum of the Undergraduate Committee comprised of Drs. Peters, Bayly, Jerina, and Gardner. The committee meets on a regular basis at least three times a year for course assessment and review. They also meet whenever other input indicates they should convene.

Further continuous exposure of the constituency to the ME objectives occurs because the Undergraduate Committee made a decision that the program and course objectives must be included in the syllabi of all Mechanical Engineering courses, beginning in the Fall of 2001. This presents the entire program to the students two or three times a year and reminds them how their courses fit together in a coherent package of engineering education.

Thus, the groups identified as our constituency have many opportunities to review and revise this list of Program Objectives. It is considered a living document, and we expect it to change and be refined in the future. It should be noted that this is our first ABET EC2000 visit for the regular program, so we are still on the learning curve. At the time of the ABET visit, further information will be available on the External Advisory Board, the Student Advisory Board, and the UMSL and WU general catalogues.

Criterion 3. Program Outcomes and Assessment.

The first task in this present documentation effort is to delineate the relationships between the ten ME Program Objectives and the ME Program Outcomes which can be used to evaluate the level of learned knowledge and abilities. Below are the outcomes that we would desire to occur for our students and which we have chosen for our program.

ME Program Outcomes

- (a) An ability to apply knowledge of mathematics, science, and engineering.
- (b) An ability to design and conduct experiments, as well as to analyze and interpret the data
- (c) An ability to design a system, component, or process to meet desired needs.
- (d) An ability to function on multi-disciplinary teams.
- (e) An ability to identify, formulate, and solve engineering problems.
- (f) An understanding of professional and ethical responsibility.
- (g) An ability to communicate effectively.
- (h) Through broad education, an ability to understand the impact of engineering solutions in a global and societal context.
- (i) A recognition of the need for, and an ability to engage in 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.

These outcomes are then related to the ten Objectives of the ME program as follows. Below is a list of the ten objectives along with the outcomes into which they feed. All upper level courses, topics studied and labs in the UMSL/WU program are identical in content to courses in the Washington University program. The parallelism of the two programs naturally results in nearly identical educational objectives for both programs. The difference in the needs of the constituents of each program are met primarily in the format of delivery. The joint program constituents are non traditional, place bound students who are employed during the day. The joint engineering education program offers an unprecedented opportunity for qualified employees in the workforce to earn a degree, with the same educational objectives as an accredited full-time program, while still fulfilling their work commitments.

Below are our ME Program Educational Objectives and how each one is supported by one or more of the outcomes.

1. Apply fundamental scientific and engineering concepts involving Dynamics, Systems, Material Science, Mechanics, Solid Mechanics, and Thermo-Fluid Sciences in order to identify, formulate and solve a variety of mechanical engineering problems that would occur in industrial practice. (Related to Program Outcomes “a” and “e”.)
2. Design, modify, conduct, and analyze experiments and experimental data in the areas of thermal-fluid sciences, solid mechanics, and dynamical systems such as would be appropriate for engineering applications. (Related to Program Outcomes “b” and “c”.)
3. Directly perform system, process, and component selection in order to satisfy specific engineering-related needs through the application of mechanical design philosophy in engineering practice. (Related to Program Outcomes “c” and “e”.)
4. Communicate in oral and written presentations using graphic and/or visual media appropriate for an engineering business environment. (Related to Program Outcome “g”.)
5. Operate productively in individual or multi-disciplinary, team-oriented projects. (Related to Program Outcome “d”.)
6. Be exposed to modern developments, products, and tools as they relate to engineering practice in the workplace today. (Related to Program Outcome “k”.)
7. Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards. (Related to Program outcome “f”.)
8. Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts. (Related to Program Outcomes “h” and “j”.)
9. Recognize the need for (and obtain the necessary tools to engage in) life-long learning to stay current in the industrial setting. (Related to Program Outcome “i”.)
10. Be afforded the opportunities to participate in cooperative education, internships, research experiences or international exchange programs in order to gain experience beyond the classroom. (Related to Program Outcome “h”.)

The letters in parentheses at the end of each of these objectives show the outcome into which it is mapped. Thus, the outcomes are the level of achievement of the “objectives”

at the time of graduation. This is further outlined in Appendix I-E. Program Outcomes and Educational Objectives are interrelated. We can control, influence, and measure the level of achievement of Program Outcomes. The Program Objectives, however, are defined as the expected achievement of graduates two or three years after graduation. They can be extrapolated from the attained level of achievement of Program Outcomes or they can be measured directly and reported by the employers of our graduates. Thus far, employers have only been willing to give anecdotal information and have not had a willingness to fill out and return questionnaires.

In preparation for ABET EC2000, we developed a strategy for assessment of how well we are achieving program objectives and, equally important, of how to take those assessments and use them to alter the program so as to better meet those objectives. Many of the above objectives have to do with metrics that must be measured on students after they have completed the program. Because we are a small school, these types of metrics, assessment tools, and feedback mechanisms are best implemented at the School-Wide Level rather than at the Departmental Level. These are being addressed in other parts of the self evaluation. In this section, we concentrate on the assessment tools that most logically fall within our own Department of Mechanical Engineering. Below are some of the methodologies now in place.

(i) Student Advisory Committee

We have formed a student advisory committee which meets twice every year to work with us on our objectives, assessment tools, and implementation of changes. They also gave us feedback on how they feel the present program is (or is not) meeting those goals and how we could improve strategies. One item that came out of those meetings was that students did not always understand how what they were learning really applied to their future careers. Therefore, in future years, we will be sharing with classes what the goals are for the program and class and helping them to understand how the particular topics in the course are aimed to those ends.

Another example of input from the Student Advisory Board was that students told us that they did not feel adequately prepared for the computing requirements of our upper-level courses. When several rounds of changes in the Computer Science curriculum failed to remedy this student complaint, we began our own computing course, MAE 265, to prepare our students for upper-level computing. This course has now been given rave reviews by the students, and we are seeing that our upper-level students are better prepared than before.

(ii) Industrial Advisory Board

We have had, for some time, a Departmental External Advisory Board that meets on a regular basis to help us evaluate our program in terms on industry needs and in terms of the practices of other universities. This Board met in the Spring of 2001 (as it had in previous years), and we relied on their input. We had the External board look at our Mission Statement and Objectives and to help us design them in the form that they are now. We also had the Board look over our curriculum and give us input as to how we could modify it to better meet their needs. In the subsequent years, we had this board concentrate on various issues. One year, the board concentrated on issue of preparedness of our graduates for the workplace. One issue was which solid modeling software tools would be expected by industry. Although, we had thought that the Board would suggest certain tools as the “latest and greatest,” they surprised us. They told us that what we were teaching was just fine (i.e., Solid Edge). They told us that, once students knew one tool, industry would have no problem in teaching them another. What they were more interested in was that the students understood the basic engineering principles (such as stresses and thermodynamics) so that they could properly interpret the results of whatever codes they were using.

Because this Board is heavily weighted with members of local industry, we have utilized it as a “Joint Board” for both the WU program and the Joint UMSL program. The Board is presently comprised of a representative from Boeing, from Emerson Electric, from a local consulting firm, and from an engineering firm on the Illinois side of the river. Thus, this Board is well in tune with the needs of the Joint Program students. the most recent meeting of the Board was March 16, 2006. Minutes of this meeting and earlier meetings can be found in the Appendices.

(iii) Course Evaluations

Another Assessment tool that we utilize is the extensive Course Evaluation Surveys given in all engineering classes. The Department Chairman looks at each evaluation form individually (including the comments on the reverse of the forms) to understand how each faculty member is doing. Every tenure-track, non-tenured faculty member is then brought in for an individual consultation as to how they are performing in terms of course content, material presentation, and general organization. In addition, for any course which falls significantly below the School-wide average, the faculty member is brought in for an individual discussion. Furthermore, for any class for which we receive any type of student complaint, the chairman brings that professor into his office to discuss the criticism (during the term) and the evaluations (at the end of the term). This past year, two affiliate faculty were brought in and specific recommendations were made on how to present the material in a manner more in keeping with our objectives. Course evaluations on our stability and control course led us to understand that students were not comprehending early in the course how this knowledge could ever be used. As a result, we have moved more concrete examples of applications early in the course cycle.

In addition to formal course evaluations, students can provide feedback on courses through other mechanisms. For example, the Registrar has set up an anonymous website to which students can go and give messages to the Dean or to Department Chairmen about

concerns in classes. In addition, students often come to the Department Chairman with complaints or other feedback on individual courses. For example, in the Fall of 2000, there was a young professor teaching his first section of Fluid mechanics. Students came to the Department Chairmen saying there were not enough classroom examples and not enough help sessions. Immediately, the professor was informed and began to do in-class examples, more TA's were assigned to the course, and more help sessions were added. Similarly, in the Spring of 2005, we began a new aircraft stability and control course. Students came to see the Chairman early in the semester to say they did not see how this course could ever be used. The Chairman talked with the professor (who was a seasoned veteran of teaching), and that professor began to add more physical insight including a video of the Wright Flier and an in-class analysis of why it was highly unstable. At the end of the year, the class evaluations were very good with students reiterating how much better the class had become through the year. A last example is that of a new computing course we introduced. After two weeks of class, students came to the Department Chairman to say that they were being "blown out of the water" by the rate of material. As a result, we cut back on the material covered and set up one class per week in a computing lab where the instructor could work out MATLAB problems on the screen as students watched. Then, students could try their own MATLAB programming while the instructor was there to help. That course is now one of the favorites and is complimented routinely in our exit interviews.

(iv) Curriculum Subcommittees

Each of our four curriculum subcommittees conducts an ongoing evaluation of the curriculum, and this is discussed openly among all faculty at our faculty meetings. Many of the changes outlined in previous sections came about through these open dialogues and feedback mechanisms. It was this committee that made the recommendation to introduce our own MAE Computing Course to introduce MATLAB early on and to make sure that MATLAB was being used by the students in each semester along the path to their senior design project.

The curriculum subcommittees also made recommendations about our Senior Design course that completely revamped it into a five-unit course in the Fall of the Senior Year, followed by a one-unit topics course in the Spring.

(v) Mentoring

Our older faculty have a good understanding through many years of how to reach the important objectives in our curriculum. Every non-tenured faculty member that joins our Department is given a Mentor to help them in their teaching plans, organization of homework and exams, and tools for making sure that important points are getting across.

(vi) Grades on Exams and Projects

Each faculty member uses the grades on Homework, Exams, and Projects as a measure of how students are doing. In our ongoing plans to prepare for ABET EC2000, we intend to put firm goals in each objective in each class that can be measured in terms of what

percentage of students either mastered, became efficient in, or were exposed to each topic. Presently, that is done in a less formal way through the distribution of grades. Some faculty have “litmus-test” problems in which a student must show proficiency before leaving that class with a passing grade. Most faculty go over exam results in class after the grading is over and stress the points in which most students were weak. These weak points are then retested in the final.

(vii) Individual Class Goals and Assessment

Each course instructor is to design goals and outcomes for his or her class in conjunction with the goals and objectives of the program. Each instructor then devises assessment strategies for that class to determine whether or not the goals are being met. The assessment tools may include pre-tests, target values for certain homework or test problems as to per cent correct, grade targets for homework and exams, etc.

(viii) ME Undergraduate Committee

In the Department of Mechanical Engineering, we have formed an Undergraduate Committee that evaluates the assessment strategy for each course and the ME Program in general. This committee consists of the Department Chairman, the Assistant Chairman, and the other ME faculty. This committee reviews the assessment strategies of each individual course as done by the instructor for that course. Evaluation is done at three different levels. First the committee evaluates whether or not the assessment strategy is adequate. If not, the committee informs the Instructor what must be done to improve the assessment strategy. Second, the committee evaluates whether or not the assessment was carried out according to plan. In other words, the committee evaluates whether or not the metrics chosen for evaluation were, in fact, measured properly. Third, the committee evaluates whether or not the Instructor made the appropriate changes to course content in order to respond to the metrics that were measured in so far as they met or did not meet the goals of the class. In this way, the assessment of individual classes has accountability within the Department.

(ix) MAE Capstone Design Course

A capstone experience has been an ABET requirement and has, for many years, been a critical part of every undergraduate degree program in the engineering school at Washington University. Capstone experiences are one of the most effective ways for engineering programs to ensure the outcomes described by ABET a-k (described above).

We recognize that course grades assigned by the course instructor are not typically considered a valid assessment method because there may be some conflict of interest involved. Nonetheless, we believe grades in a capstone experience can provide a reasonable assessment of a student’s preparation for entry into the engineering profession. The capstone course really does not focus on presenting new material to learn or understand. That has been the focus of the required (and elective) course work leading up to the capstone experience. The purpose of the capstone experience is to provide an opportunity for students to synthesize “all” they have learned in their engineering curriculum in a mentoring environment, and often involves problems posed by outside clients. When outside clients are

involved, they typically provide evaluations of the students' work that are considered in assigning grades.

Engineering analysis and design principles learned in preparatory engineering courses, along with considerations such as economics, legal and regulatory requirements, ergonomics, ethics, aesthetics, marketing – subjects learned in other courses, often from other divisions of the University – all come to bear on the student's capstone experience to produce a creditable engineering solution to a problem.

The grade a student earns in a statics course, for example, may be considered tainted as an assessment method because it may not only reflect how well the student knows statics, but it may also reflect how well the instructor assigning the grade can teach statics. While we recognize the grade on a capstone experience is still an imperfect method, we believe the grade earned in a capstone experience really reflects the student's holistic preparation for the practice of engineering – it is a direct assessment by one instructor of how well-prepared the student is on the basis of what he or she has learned from many instructors in many courses.

(x) Exit Interviews

Exit interviews are held on a periodic basis with graduating seniors. These interviews also provide an assessment means whereby we can obtain feedback on the effectiveness of our program.

(xi) Additional Data

Table 3.1 gives a matrix of the Outcomes and the assessment tools. Squares with an "S" indicated a strong level of feedback through this mechanism. Squares with an "M" indicate a moderate level of feedback. Squares with no entry indicate a small amount of feedback through this mechanism.

Appendix I-E gives correlation of the courses with the outcomes. Appendix I-F contains samples of minutes and notes on Student Advisory Committees and student course evaluations. Appendix I-G gives examples of meetings of External Advisory Boards, Alumni Data, and Exit Interviews. Appendix I-H gives examples of changes in our program that were made because of this feedback process.

Table 3.1

Assessment Procedures	a	b	c	d	e	f	g	h	i	j	k
Student Advisory Committee	M	M	M	S	S	S	S	S	S	S	M
Industrial Advisor Board			M	S	S	S	S	S	S	M	M
Course Evaluations	M	M	S	M	M	M	M				M
Curriculum Subcommittees	M	M	S	M	M	S	S				M
Mentoring						M		M	M	M	
Grades on Exams and Projects	S	S	S	S	S		S				S
Exit Interviews	S	M	M	S	M	S	S	S	S	S	M
Individual Class Goals & Assessment	S	S	S	S	S		S				S
MAE Capstone Design Course	S	S	S	S	S	M	S	M		M	S
Course Notebooks	S	S	S	M	M		M				M
Alumni Survey	S	S	S	S	S	M	S	S	S	S	S

S = Strong, M = Medium

Further Assessment of Program Outcomes

The ten Program Objectives and eleven Program Outcomes are mapped into each Engineering Class in the program according to the Tables in Appendix I-E. This insures that each objective and outcome is addressed somewhere in the program. Although the table does not give any numerical weights as to what extent any given course impacts a particular outcome, the individual class files available at the time of the ABET visit will address this. Each course has a file in which the objectives, outcomes, and assessment procedures are given. Design content for the course is evaluated. Each notebook also includes copies of all handouts, and three levels of examples of homework, labs, and exams. This notebook is revised on a regular basis for each course.

Each notebook begins with the outcomes and objectives that the particular course addresses. The notebook is prepared by the instructor. The course book not only gives examples of work, but also of assessment objectives. The first assessment, then, comes from the instructor. The instructor explains in the class notebook both how the outcomes are addressed in that course as well as how they are assessed in the course. In order to accomplish this, all Course Masters and instructors in the program were told individually what was expected of them. Next, the ME undergraduate committee met to evaluate the final set of course materials and assessment set up by each course master and instructor (see Appendix I-G). Feedback was then given to each instructor about how to improve the assessment mechanism for that particular course.

Appendix I-G gives samples of detailed documentation of the assessment mechanisms used by the instructor to insure that the goals and objectives were being met. These illustrate several examples of how different faculty members approached the problem of assessment of the objectives in their courses. Also in Appendix I-G are the minutes of the meetings of the UG Committee evaluating the various course assessment strategies. Examples are included of how a course, its objectives, or its assessment strategies were changed based on the committee review. Also included are the sample minutes from recent meetings.

We are not as yet to the point at which we can assign numerical goals to many of the assessment criteria. Obviously, for grades, we have strict quantitative rules in place as to what grades are required for graduation. Similarly, within each course (and within the Capstone Design Course) each instructor has set up quantitative markers on how well students must perform on various exam problems, homework problems, and lab exercises in order to pass the course. Similarly, for classroom teaching evaluations, we know that a score of 2.5 is low, and a score of 4.0 is good for a particular instructor or course, so that the Department Chairman can know when to step in and make feedback corrections for a particular case. However, we do not have enough data on alumni surveys and exit interviews to know quantitatively how many students or alumni need to feel strongly about a certain issue before we need to do something about it. That is an area where we need to improve in the future.

Constituency

In addition to the above assessment of our outcomes by the individual instructors and by the faculty committees, we realize that we need to have some assessment by our other constituents. In this case, we consider five categories of constituents. First, there are the students presently in the program; second, there are the student alumni who have already

graduated; third, there are the employers of our alumni; and, fourth, there are the industry leaders for whom an educated work force implies a stronger infrastructure and a stronger community. Fifth, there is the faculty.

First, let us discuss assessment by our present students through course evaluations. Every course is evaluated by the students at the end of each semester. The normal evaluation forms are prepared by the Washington University Engineering Student Council, and we apply these same forms to both the Day-school sections and Joint Program sections. Thus, the evaluation of each course by either student group is used to affect both programs. In Appendix I-F, one will find several examples of these student evaluation forms. The Department Chairman goes over all forms for every course every semester with special emphasis on courses with new faculty, adjunct faculty, or for which student feedback has been received during the semester. Based on this, faculty are called in for consultation; and changes are made to the courses based on relevant student feedback. Appendix I-H gives examples of some of these changes that were made. For example, in Fluid Mechanics, the professor was told to add more classroom examples to the lectures. In another case, the professor was asked to add an additional help session. In each case, the change was made with good feedback from students.

However, the existing forms do not completely cover the objectives and outcomes of the program. Therefore, a set of Supplemental Questions was formed and added to the normal classroom evaluations beginning in the Fall 2000 semester. Appendix I-F gives the list of Supplemental Questions added to the SEAS course evaluations. One can see in the Appendix that the Supplemental Questions address most of the outcomes and objectives that are not treated by the original form. Once again, the Department Chairman looks over these. When the Undergraduate Committee meets to discuss the objectives and outcomes for each course, the results of these surveys are considered. They are part of the process by which it is decided which courses meet the claimed objectives and which do not. Based on this, the goals of each course are revised to indicate accurately which of the outcomes and objectives are being addressed. In no case was it found that a deficiency in an individual course compromised the overall outcome for the program.

A second way in which existing students are involved in the assessment process is in the organization of the Student Advisory Boards. Two separate committees were formed beginning in the Spring of 2000. One is a committee consisting of ME Day-School students. The second is made up of ME Joint Program students. In the Spring of 2000, the Day-School students were asked to review several aspects of our program including the objectives and outcomes. Each student was sent the (a) – (k) list of outcomes in advance and asked to comment both on how well we were doing at those as well as to give us ideas on what they thought the objectives should be. After the students had a chance to review these, the committee was convened so that the students could comment in more detail. A summary of that meeting is in Appendix I-F. That committee met again in the Fall of 2000 and in every Fall thereafter to initiate new members. Some of these same as ideas (as well as other aspects of the program) were addressed at each meeting. The UMSL students were first involved in the Spring of 2001. They were asked to comment on how well we were meeting the objectives and outcomes. They were also asked for firm ideas on how we could improve the program. The Joint Program Student Advisory Board has met every year since then. Summaries of some of these meetings are in Appendix I-F.

In the Day-School Program, we have a very good alumni network and are constantly receiving input from our alumni as to how well they are prepared for an engineering career. For that program, we have instituted an alumni questionnaire to transition from an anecdotal

system to a quantitative one. We have already received initial data from these alumni questionnaires, and these have given us good feedback that we are meeting our Objectives. [See App. I-H] We also have direct feedback from Washington University alumni telling us the strengths (and, in some cases, the weaknesses) that they perceived. For example, one of the negative comments we received was that graduates felt they had not received sufficient experience in working in teams. Based on that comment, we have set up rules for our classes that make it easier for students to work in teams on homework problems without being accused of cheating. Several professors have been contacted on an individual basis and asked if they would reconsider how they treat collaboration on labs and homework.

For the UMSL program, the degree is much newer; and we do not have as many alumni to consider. The University of Missouri is presently working on better ways to keep track of and poll the alumni to receive feedback about our system. Several of the UMSL graduates, however, have ended up as Master of Science Students in Mechanical Engineering in our WU program, and this puts them into our WU alumni web.

Another assessment tool is the Fundamentals of Engineering (FE) Exam. Starting last year, we have agreed to pay the fees for anyone wishing to take that exam. As a result, we are now receiving our first feedback on how our students do on this exam. In the future, we hope to receive more specific data by engineering area.

Finally, all students in the ME program are given exit interviews by the chair, Dr. Peters. Some examples of these are given in Appendix I-F. The Department Chairman invites all graduates in for exit interviews with about a 25% participation rate. Students are asked detailed questions about their experience here, and the information is used to improve the system. For example, the exit interviews in Spring of 2005 were used to verify that the Aircraft Stability and Control Course had been improved over the first time it was taught. Input from those Exit Interviews was also used to make the decision to continue to include homework as part of the grade for several upper-level courses. Input from exit interviews in 2004 identified that some sections of Materials Science taught by other departments were no longer doing meaningful laboratory exercises. As a result, all ME students were required to do the ME lab no matter which section of Materials Science they were enrolled in (CHE or ME).

External Constituents

The bringing in of industrial and other external constituents is an important part of our assessment process. In the Spring of 1999, the School of Engineering and Applied Science held a retreat in which we discussed the transition to ABET EC2000 along with the necessity of goals, objectives, and outcomes assessment. We then took our ideas to our National Council who gave us feedback on the Day-School and Joint Programs and how well they prepare our graduates for engineering practice. Next, the individual departments (including ME), held retreats in which we asked our friends in industry to help us with our own individual program assessment. We then formed an External Advisory Board for Mechanical Engineering. This Board includes five people. At that time, they were: Dr. Alan Atkins, V.P. of Engineering for Boeing St. Louis; Dr. Harold Law, owner of his own Engineering Consulting Firm, CACI; Dr. Andrew Swift, Dean of Engineering at University Texas, El Paso; Dr. Swami Karunamoorthy, Associate Dean of Engineering, St. Louis University; and Hal Faught, V.P. of Engineering for Emerson Electric Company of St. Louis. The National Council and the ME External Advisory Board were asked to give us feedback into the nature of our program, our goals, and how our graduates could be better prepared for

industry or graduate school. We also asked for external advice from Dr. Ramesh Agarwal, who is an ABET evaluator. At that time, he was on the faculty of Wichita State and had done two ABET EC2000 visits. (Presently, he is a member of our MAE faculty here at Washington University and is a leader in our assessment strategies.) Based on the inputs from these external constituents, we set up a Course Master Plan for classes taught by adjunct faculty. The external advisors thought that this would be a good way to keep close contact with the Joint Program course content and to keep strong communication between the Joint Program and the Day-School Program. In this way, we could better insure that outcomes were being treated uniformly in either program. The affiliates who teach in our Joint Program (and, to a lesser extent in our Day-School Program) are all from the local St. Louis industrial base. Thus, they also give us direct feedback and direct changes to courses to make sure students are prepared for an industrial career. We have recently named new a new set of Board Members, and they met in Spring of 2006.

We have been unsuccessful in convincing employers to fill out any forms relating to how well our graduates are doing at their companies. This reluctance is even present at large corporations who have a strong interest in ABET. However, the starting salaries of our graduates and their acceptance into graduate schools are both very good feedback measures of how industry and universities view the quality of our product. For the Spring semester of 2001, our graduates had the largest average starting salaries of any of the WU engineering departments. All of our graduates were either placed in graduate school programs or found jobs. Graduate recruiters return again and again to our University seeking our graduates. Our students win many National Awards for their work including NSF Graduate Fellowships. In 2001, one of our Senior Design Projects (on the Design of Automatic Reset of Industrial Circuit Breakers) won the second place award at an International Design Competition in Singapore. Our robotics team finished second in a recent National competition, and our Spacecraft Design Team, recently finished fifth out of forty applicants in which the other top four teams came from very large State Schools with an entire course devoted to the design of the spacecraft in question.

All of the following groups have been in place for more than ten years and give us feedback on the Day School and Joint Programs (and have been doing so since the inception of the Joint Program). Some of these are mentioned above, but we list them below in a little more detail.

1. SEAS National Council. This is a group of 30-40 distinguished professionals who are typically senior executives from local industry. They meet once a year and review each of the engineering programs, their activities, their objectives, and the research projects through presentations by department chairs and individual faculty.
2. Department Chairmen Retreat. Dean Christopher Byrnes schedules a one-day retreat each year for he and the Department Chairs to meet at an off-campus location and consider matters germane to the Engineering programs.
3. Executive Committee. The Executive Committee of the School of Engineering and Applied Science is comprised of the Dean, the Department Chairs, two Associate Deans, and the head of our Continuing Engineering Education Division. This committee meets bi-weekly and discusses academic matters that pertain to the Engineering Programs.

4. Faculty Assembly. The membership of this group is made up of all tenure-track faculty in the School of Engineering and Applied Science (SEAS). This group meets four times a year and discusses and votes on matters of courses, programs, and requirements.
5. Mechanical and Aerospace Engineering Retreat. The faculty of the Department of Mechanical and Aerospace Engineering (including the Chairman) meet off campus on one to two days each year to discuss long-term issues that affect our programs and the quality of our graduates.
6. MAE Faculty Meetings. The Mechanical Engineering Faculty meets 6 to 8 times each semester discuss matters of immediate impact on our curriculum and students.
7. Undergraduate Board. This committee is comprised of faculty from each Department along with student representation. Dean Kroeger, the engineering Registrar, chairs these meetings. This committee meets as needed to consider changes to common requirements for engineering programs.
8. External Advisory Board. This group of external assessors from government, industry, and other universities meets every one to two years to discuss our goals, objectives, outcomes, and assessment strategies.
9. Curriculum Subcommittees. The Department of Mechanical Engineering has subcommittees for mechanics and materials, mechanisms and mechanical design, dynamics and control, and fluid and thermal sciences. These committees review our graduate and undergraduate curriculum on a regular basis and recommend improvements.

All of the above-mentioned groups involve various constituents of our program in order to give us assessment feedback for both our Day-School and our Joint Program.

In summary, the following assessment procedures are in place and operational.

- Course Evaluations
- Anonymous Website
- Students' Direct Comments
- Exit Interviews
- Instructor Course Outcomes Evaluations
- Undergraduate Committee
- Executive Committee
- MAE Faculty Meetings
- Engineering Faculty Assembly
- Retreats at Engineering and MAE levels
- Surveys of Alumni
- External Advisory Board
- National Council
- In-Class Exams and Homework
- FE Exam

The following lists documents just a few of the changes that we have made to the program based on discussion and feedback with the Joint Program constituency.

- 1.) The final set of objectives was changed based on input from students and industry.
- 2.) We added a course in Engineering Project Management to the curriculum based on input from our student advisory committee.
- 3.) We provided input back to EE about deficiencies in their fundamental circuits course and EE electives which led them to revamp their courses completely.
- 4.) Based in feedback from students and from our External Advisory Board, we formed a committee to change our computing requirement. That committee gave the recommendation that we start our own MAE computing course taught by a practicing mechanical engineer with a degree in applied mathematics, MAE 265. That new course has received rave reviews. We are now moving towards making that a required course in the Joint program, as well.
- 5.) Based on feedback from our undergraduate board, we introduced an undergraduate manufacturing course at the sophomore level., MAE 204. This course allows students to use their CAD skills early on in their career here. Our next step is to offer a section of this course in the Joint Program.
- 6.) Our thermodynamics course was completely revamped due to inputs received in exit interviews, from course evaluations, and from the professors in the follow-on courses. We hired two new faculty in thermodynamics (Eliot Fried and Amy Shen) and they completely modernized the course and began teaching it in tandem. Feedback from the follow-up courses (Energetics and Propulsion) indicates that the present thermodynamics course is preparing the students well for follow-on courses. Since the teachers of Thermo in our WU program are the course masters for the UMSL sections, this information has been filtered into that system, as well.
- 7.) Based on feedback from students and from our Industrial Advisory Board, the Freshman Introduction to Design was changed from a 3-unit course that treated both design and CAD to two 2-unit courses one of which does design and one of which does CAD. These can be taken concurrently or sequentially in either order which has also given more flexibility to our Freshmen. The UMSL Student Advisory Board was very influential in this decision, as they often take CAD somewhere else and come in only needing the design portion. The change began in the Fall of 2002 and has been very good for them.
- 8.) Based on complaints from students that the controls courses (MAE 431, ESE 441) do not have much of an MAE flair when taken in other departments, we introduced the new MAE 433 Aircraft Stability and Control to give more of a Mechanical and Aerospace focus. This feedback also was used to update JME 4310.
- 9.) Due to feedback from the instructor of the Joint Program JME 4310, we added JME 2300 (circuits) as a prerequisite to this course. As a result, we also went to Electrical Engineering and indicated that our WU students were not receiving the training in circuits they needed. As a result, the ESE department revamped the introductory circuits courses to give more hands-on experience with circuits, resulting in ESE 102.

10.) Our student advisory board told us that there was too big of a gap between their preliminary design project (spring junior year) and their detailed designs (fall senior year). They also indicated that the detailed design was far more work than the number of credit hours indicated. As a result we completely changed our senior design sequence. The preliminary and final design were put together in a 5-unit course taught in the Fall, and engineering topics (such as ethics, litigation, cradle-to-grave design) were put into a separate 1-unit course taught in the spring of the senior year. The Junior year design experience was correspondingly revamped into a combination of Machine Design and Analytic Approaches to Design. This change was transitioned to in the Day School between January 2001 and December 2002 and it was introduced into the Joint Program in Summer of 2002.

11.) More help sessions were added and more example problems done in class in Fluid Mechanics based on student feedback.

12.) Due to feedback from the UMSL Student Advisory Board, we began a broad advertising campaign to let UMSL students know that we offered free tutoring for any engineering course at WU.

13.) In order to obtain more assessment data, as recommended by our External Advisory Board, we strengthened the office on the UMSL campus to better tell students how they could take the FE Exam.

14.) Based on feedback from faculty and advisors, an email system was set up for contacting all UMSL students.

15.) Several feedback situations from students led the Assistant Chairman, Dr. Gardner, to make changes in classroom teaching space.

16.) Due to meetings on accreditation with Department Chairs, goals and objectives are now handed out with the syllabus in each class.

Assessment of transfer students and transfer credits.

As an example of assessment, in the summer of 2005, the faculty teaching the UMSL section of our Mechanics of Deformable Bodies sent a letter to the Department Chairman stating that the quality of the UMSL students' knowledge of Statics was beginning to drop. By the Spring of 2006, the quality had dropped enough that we had a special meeting and made the following changes:

1.) Special sessions lasting 1.5 hours after each class were set up for remedial work on statics.

2.) The first exam was delayed until after Spring Break.

3.) Extra tutors were assigned to statics so students could take advantage of these. (Tutoring is provided free of charge.)

4.) A graduate student was hired to set up special help sessions during Spring break to give remedial work on statics.

5.) The instructor of the course also set up special help sessions during Spring Break to give aid in the primary course material.

We will evaluate this process at the end of the semester and see what we should do for next year.

Criterion 4. Professional Component.

All Day-School students majoring in mechanical engineering must complete a minimum of 126 units and satisfy the requirements of the *Common Studies Program* of the School of Engineering. Students in the Joint Program must earn a minimum of 139 units for graduation. All students who have been admitted to the Joint ME Program have complete engineering courses which are the equivalent of this Common Studies Requirement. Courses specifically required by the Common Studies Program are the following:

Area	WU Course Requirement	UMSL Course Requirement
Composition	Ecomp 100, Expository Writing	English 1100, Expository Writing (<i>or</i> by examination)
Calculus	Math 131, Calculus I and Math 132, Calculus II and Math 233, Calculus III <i>or</i> Math 141, Accelerated Calculus I and Math 142, Accelerated Calculus II Math 217, Differential Equations	Math 1800 Calculus I Math 1900 Calculus II Math 2000 Calculus III Math 2020 Differential Eq.
Physics	Phys 117A, General Physics I Phys 118A, General Physics II	Physics 2111, Mechanics & Heat Physics 2112, Electricity, Magnetism & Optics
Chemistry	Chem 111A, General Chemistry I Chem 112A, General Chemistry II Chem 151, General Chemistry Lab.	Chem 1111 Intro. Chem. I Chem 1121 Intro. Chem. II
Technical Writing	EP 310, Technical Writing	JEC 3100 Tech. Writing

Additional courses required for UMSL students to enter the engineering program are:

Statics	MAE 231	Eng 2310
Dynamics	MAE 232	Eng. 2320

Secondly, the Common Studies Program stipulates that each mechanical engineering student must select a minimum of four courses in at least three different engineering departments. Of these four, no more than one course is allowed from the following groups:

UMSL Engineering Core

- A. ESE 202, Introduction to Systems Science and Mathematics I
- B. Phys 217, Introduction to Quantum Physics I
- C. CE/MAE 231, Engineering Mechanics I *or* CE/MAE 241, Mechanics of Deformable Bodies
- D. CS 102G, Introduction to Computer Science II *or* CS 136G, Introduction to Computing *or* CS 265, Introduction to Computing and Computer Applications
JCS 1002 MATLAB
JCS 1260 Intro to Programming
- E. EP 252, Technology, Values, and Society *or* EP 261, Energy and Human Affairs *or* EP 262, Pollution and Environmental Impact
- F. ESE 230, Introduction to Electrical Networks
JEE 2300 Intro to Electrical Networks
JEE 2330 Circuits Lab
- G. ESE 317, Engineering Mathematics
JEMT 3170 Eng. Math.
- H. ChemE/ME 320A, Thermodynamics
JME 3200 Thermodynamics
- I. ESE 325, Engineering Statistics *or* ESE 326, Engineering Probability *or* ESE 326A, Probability and Statistics for Engineering
- J. ChE 351, Engineering Analysis of Chemical Systems
JME 4310 Control Systems

Humanities and Social Sciences Requirement. Joint Program students must meet the UMSL General education requirements. In particular, a course in American history or government or in Missouri history or government must be included. The cultural diversity requirement must also be fulfilled. (Some courses which fulfill the humanities or social sciences breadth of study requirements may not count as humanities and social science electives.)

Departmental Requirements. The mechanical engineering major in the fourth year must elect four upper level engineering courses (12 units). These are generally chosen from the Department's offerings at the 300 and 400 levels. Selected 500-level (graduate) ME courses are also allowed as well as certain courses offered by the other engineering departments, but courses in these categories must receive prior approval from the student's advisor. Students admitted to the Combined BS-MS program are required to take the applied mathematics sequence, ESE 501-502, "Mathematics of Modern Engineering I, II" in place of two technical electives. Similarly, students pursuing the premedical option through mechanical engineering can replace two technical electives by a sequence in organic chemistry.

Design Requirement. Even though ABET no longer has a formal design requirement, candidates for the BSME must accumulate a minimum of 17.25 units of design. The design experience culminates in a six unit sequence, MAE 404P and MAE 404T in the WU Program

or JME 4040 and JME 4041 in the Joint Program. A complete set of course descriptions in the prescribed format is included in Appendix I-B. That Appendix includes descriptions of all required engineering courses and electives that are offered at least annually.

Oral and written communication

The program seeks to assure the development of competence in oral and written communication in a number of ways. First, there is the English Composition Requirement, which is expected to establish basic proficiency in reading and writing the English language. Secondly, mechanical engineering majors are required to take EP310, "Technical Writing," no later than their sixth semester. In this course students carry out extensive analyses and composition of memoranda, letters and technical reports. The course includes experience in both written and oral communication skills. Students make classroom presentations that are videotaped for in-class critique. Section size is limited to 15 in order to maintain good contact between instructor and students.

Finally written and oral communication skills are emphasized in all of the required laboratories and in the senior design project courses. Written laboratory reports, both individual and group reports, are required in JME 3221 "Machine Design," JME 3250 "Materials Science," JME 3721 "Fluid Mechanics," JME 3722 "Heat Transfer," and JME 4180 "Dynamic Response." Oral presentations of feasibility studies and design projects are required in ME 404P and 404T (JME 4040 and 4041). In all cases technical reports are graded on both technical content and the quality of presentation. Correct grammar and good composition are considered as essential aspects of a professional quality presentation.

Computer experience

The students' first substantial exposure to engineering applications of computers comes in MAE 041C and MAE 141D (JME 1413 and 1414), "Introduction to Engineering Design," which is required for all ME majors. A principal goal of this course is to introduce computer-aided design and drawing. Classes meet five hours per week in a specially equipped computer lab. Almost all class time is spent on the computer using AutoCAD or Silver Screen or Solid-Edge computer-aided drawing software. Solid modeling techniques are taught and a design project is carried out using solid modeling culminating in detail and assembly drawings.

In the fourth semester of the program students enroll either in CS 265 (JCS 1260 and 1002), "Introduction to Computing and Computer Applications," a three-unit course required for all ME majors or in MAE 265 Introduction to Mechanical Engineering Computing, which is an introduction to MATLAB. In the former course the basic architectural components of computers and their functions are introduced, computer-oriented problem-solving techniques are developed, and the implementation of these techniques as programming is taught. The "C" language is used along with several software libraries, including MATLAB. Students develop and test a variety of programs designed to acquaint them with a broad spectrum of nontrivial computer applications. In the latter course, concepts of computer architecture and numerical applications are matched with ME problems through the vehicle of MATLAB only.

Laboratory experience

In their first and second years all engineering students are required to take two semesters of chemistry and two semesters of physics as part of the common studies requirement. Each of these eight-unit sequences include two units of laboratory. Beyond this experience, students who major in mechanical engineering receive a minimum of 6.5 units of laboratory instruction in required courses solely. The particular courses and their laboratory content are:

JME 1414 (MAE 141A), Introduction to Engineering Design: 2.0 of 4.0 units;
JME 3250 (MAE 325), Materials Science: 1 of 4 units;
JME 3721 (MAE 372A), Fluid Mechanics Laboratory: 1 unit;
JME 3722 (MAE 372B, Heat Transfer Laboratory): 1 unit;
JME 4040 (MAE 404P), Mechanical Engineering Design Laboratory: 1 unit;
JME 4180 (MAE 417), Dynamic Response of Physical Systems: 2 of 4 units.

In all of the instructional laboratories, exercises are designed to relate theory encountered in the lecture component of the course to actual physical phenomena. This involves demonstration as well as quantitative measurements. The latter aspect invariably provides “hands on” experience with a variety of equipment and laboratory instrumentation. The acquisition, processing and analysis of data are carried out manually in some cases and by automated, computer-assisted methods in others.

An explicit function of the required ME laboratories is training in the methodology of experimentation, e.g., recording procedural details and raw data collected in a laboratory notebook, and preparation of formal reports written in good technical English.

Safety issues are dealt with locally at the time the students are introduced to the particular apparatus they will use in an exercise. During the conduct of the exercise, supervision is provided by a faculty member or a trained teaching assistant. Rotating machinery is protected by guards wherever access is not necessary. Where rotating elements must be exposed, students are required to tie up long hair, and to remove neckties and dangling jewelry. Generally speaking, the risk of electric shock or exposure to toxic materials is low to non-existent in the mechanical engineering laboratories. On the other hand, noise levels are high in some areas. For instance, in the Fluid Mechanics Laboratory, next to the wind tunnel when operating at high speed, students are required to wear ear protection.

Engineering design experience

The present curriculum provides a minimum design content of 17.25 units with additional design units likely to be gained from four technical elective courses (200, 300 or 400 level) that every mechanical engineer must take. The total experience culminates in a five-unit course, JMEE 4040, Mechanical Engineering Design. This constitutes the “capstone” experience.

In the first part of JME 4040, students are required individually to perform a feasibility study for a particular project selected from a menu. Projects on the menu are composed by a team of four faculty members with some input from local industrial contacts. An effort is made to define projects that are open-ended, original designs or creative redesigns of a mechanical component or system, and which will require the application of engineering science principles inherent to mechanical engineering. Feasibility is considered

subject to economic, safety, legal, environmental, ethical, aesthetic, and possibly other constraints in a competitive manufacturing environment. In parallel with the individual studies a case study is performed by the entire class under the direction of the coordinating instructor.

In the second part of JME 4040, the feasibility studies performed by the students are reviewed for substance, relevance and educational value. Some of these are then selected to make up a menu of design projects from which teams of one to three students choose a project and carry out the design to completion. In parallel with these team efforts, a special design project is tackled by the entire class under the supervision of one of the assigned professors. Reports on the team projects are presented orally to a panel of faculty members and industrial representatives who evaluate the designs. These reports must be delivered in camera-ready form and are published in a bound volume. Prototype construction is encouraged for a few of the designs, depending upon student interest and capabilities, and the financial and material support required.

Although the design content of the mechanical engineering curriculum exceeds the old ABET criteria, the Department is sensitive to the evolution taking place with respect to a more effective integration of design throughout the four years. A majority of the present Mechanical Engineering faculty are in agreement with this philosophy, but feel strongly that the interdisciplinarity of design in modern engineering practice must be introduced at the earliest possible stage. There is also concern about how a major curricular reform, reaching into the first year, can be accomplished without a substantial increase in the number of full-time faculty. The Dean of Engineering has appointed a School-wide committee to examine the possibilities for significant reform of the first-year curriculum of all students entering the school, with particular emphasis on the introduction of creative interdisciplinary design, teamwork, and the professional aspects of engineering.

Satisfaction of breadth and depth requirements in the humanities and social sciences

The student's choice of humanities and social sciences electives must meet both the UM-St. Louis General Education Requirements and the Humanities and Social Sciences Requirements of the Joint Undergraduate Engineering Program.

- Three courses in the humanities and 3 courses in social sciences must be taken
- One of the social sciences must be a course in American history or government or in Missouri history or government
- One of the humanities or social science courses must be at the junior level or above
- The cultural diversity requirement must be fulfilled.

Probability and statistics applied to engineering problems

All Joint Mechanical Engineering students are required to take JEMT 3260, "Probability and Statistics for Engineering." In the laboratory courses, they are required to estimate experimental uncertainties in specific measurements and then figure out how they propagate through engineering calculations. These concepts are introduced first in the laboratories that accompany the first-year general physics sequence and then reintroduced in succeeding mechanical engineering laboratories, such as fluid mechanics (JME 3721), heat transfer (JME 3722), and vibrations (JME 4170-4180). In all of the exercises where physical measurements are made, the statistical character of engineering data and the importance of a realistic appraisal of uncertainty in the final results are emphasized. However, the analysis of

experimental uncertainty usually stops short of a rigorous analysis of variance simply because the numbers of repeated measurements are usually too small.

The **thermal and fluids** stem of the curriculum consists of six required courses:

JME 3200 (MAE 320A), Thermodynamics	3 units
JME 3210 (MAE 321), Energetics for Mechanical Engineers	3 units
JME 3700 (MAE 370), Fluid Mechanics	3 units
JME 3710 (MAE 371), Principles of Heat Transfer	3 units
JME 3721 (MAE 372A), Fluid Mechanics Laboratory	1 unit
JME 3722 (MAE 372B), Heat Transfer Laboratory	1 unit

Plus supplementary electives. MAE 472, Fluid Mechanics II, is strongly recommended.

In the required fluid mechanics course, JME 3700, the subject of turbulent flow is introduced, and in this context the students learn about mean and randomly fluctuating velocity components, as well as the cross correlations known as the “Reynolds stresses.” In the subsequent fluid mechanics and heat transfer laboratories, they actually measure mean velocity, rms of the streamwise velocity fluctuation, and hence the turbulence intensity.

The **dynamics/controls, mechanisms and machine design, and mechanics/materials** stems consist of:

JME 1414 (MAE 141A) Intro to Design	4 units
ENG 2320 (MAE 232) Dynamics	3 units
JME 2410 (MAE 241), Mechanics of Deformable Bodies	3 units
JME 3221 (MAE 322), Introduction to Machine Design	4 units
JME 3250 (MAE 325) Materials Science	3 units
JME 4170-4180 (MAE 417) Dynamic Response of Physical Systems	4 units
JME 4310 (MAE 433), Control Systems I	3 units

Plus supplementary electives. MAE 570, Advanced Analysis and Design of Machine Members, and MAE 572, Dynamics and Vibrations of Machines, are strongly recommended.

The program requires two courses in the electrical sciences:

JEE 2300 (ESE 230), Introduction to Electrical Networks	3 units
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and one of the following:

JEE 2330 (ESE 233), Electrical Laboratory I	3 units
ESE 2320, Introduction to Digital and Linear Electronics	3 units
ESE 3320, Power, Energy and Polyphase Circuits	3 units
ESE 3300, Engineering Electromagnetics I	3 units

Criterion 5. Faculty

Mechanical Engineering has 16.5 full-time and 14 affiliate faculty involved with either the day-school program or the evening Joint ME Program. Every upper-level course is either taught by one of our full-time faculty or has a full-time faculty as the course master. Faculty-student interaction usually takes place before or after classes or at special help sessions organized by the instructor. There are sufficient numbers and technical competence in this group to cover all curricular areas of the program and have good levels student-faculty interaction.

The issue of *competence* is best addressed by referral to the information given in the faculty biographies. It may be noted that fourteen of the regular faculty are supporting active research programs by means of competitively won grants and contracts, and seven have achieved Fellow status in professional societies. The issue of *currency* is also a Program Requirement (Criterion 8) for Mechanical Engineering programs. Full-time faculty maintain their currency by their research efforts which result in technical meeting presentation and publication of results in peer-reviewed scientific journals. Affiliate faculty work full time in professional positions in the St. Louis area. Their work experience is part of the reason why they were appointed to their part-time positions to teach at the university. Fore example, if they work for Boeing, they might teach fluids, thermodynamics, vibrations or control systems in the program. Currency in their area of their specialty is a prerequisite for both positions. The resumes of full-time and part-time faculty in the Joint ME Program demonstrate they are current in their areas of specialization.

With respect to faculty workload, the regular faculty who are actively engaged in scholarly research and participating in advising and other departmental administrative duties are normally assigned one or two preparations per semester. By preparation is meant (i) one section of a three-unit lecture course, or (ii) a laboratory course (nominally one unit) or (iii) participation in the senior design courses as a supervisor/consultant. The actual number of preparations assigned to a particular professor is determined each semester by several factors, including his commitment to sponsored research projects, prior experience with the class or laboratory, the number of students enrolled, his advising and other administrative duties. The traditional definition of a full-time teaching load in the School of Engineering is four courses or 12 units per semester. However, experience with the Department's non-lecture courses, i.e., laboratories, and design project courses, where contact time between the professor and small groups and individual students is necessarily great, shows that units alone cannot be used reliably to measure faculty work load.

With regard to industrial interaction of the faculty, the university allows one day per week for consulting with local industry. This activity could be in product development or product failure analysis for local manufacturing firms. Affiliate faculty, of course, work full time in industry and bring their special expertise into the classroom when they teach courses for us.

Criterion 6. Facilities.

Library. The engineering collection is housed in the central Olin Library. Presently Olin contains more than 1.5 million volumes including many that are relevant to mechanical engineering. The resources of the library are easily accessible to students and faculty. By means of its interlibrary loan arrangements Olin can quickly obtain books and journals that it does not own from other libraries. Faculty members can request that specific reference materials be placed on reserve for students enrolled in their courses. Beyond Olin Library

there are other libraries of importance to the engineering community on the main campus. These are located in the departments of Biology, Chemistry, Mathematics, and Physics. Another library with extensive collections in the life sciences is at the School of Medicine. Altogether the Washington University Library system possesses close to three million documents which are maintained by a staff of 292.

Computer services. Mechanical Engineering students and faculty are served by the Mechanical Engineering Computing Facilities (MECF) and also by the Center for Engineering Computing (CEC). The CEC is the primary source of computing services for undergraduate students. Its facilities include computer-aided teaching classrooms, consulting services, and computer labs with a large variety of software packages used by all engineering students. Labs are generally open 24 hours per day during Spring and Fall semesters. The MECF provides computer, email, and network services to the students, faculty, and staff in the Mechanical Engineering department. The network backbone is fiber-optic cable, while the desktop connections are 10/100 Base T. The network spans several building in the School of Engineering and Applied Science: Jolley Hall, Urbauer Hall, Sever Hall, and Bryan Hall. The MAE network is also connected to the campus-wide network backbone, giving access to other Washington University computing resources and the internet.

The Mechanical Engineering department has an eclectic mix of UNIX workstations, Macs, PCs, and X terminals. The UNIX computers are primarily SGI (Silicon Graphics), Sun Microsystems, and DEC Alpha varieties. The department's mail server and web server are both Sun UltraSPARCs. There are currently two SGI Challenge servers, one of which is a 12-processor Challenge L with 40 GB of disk and 1GB of RAM. Also there are SGI Octane, O2, and Indy workstations. Software available on MAE servers includes Matlab, Mathematica, Fluent, and Gambit.

There are several locations within the department that are maintained for student computing. The CAD (Computer-Aided Design) lab has 16 PCs which run software from the leading CAD vendors, Unigraphics, IronCAD, and Solid-Edge. Students can access the lab during evenings and weekends through a card-entry system. The CFD (computational Fluid Dynamics) Lab has several SGI workstations, and most of the instructional labs have computers dedicated to data-acquisition on experiments. CEC facilities are open 24 hours a day, seven days a week. CEC machines are available for instructional computing only. CEC also staffs a help center that is open a total of 85 hours a week, including 15 hours on weekends. CEC has five full-time and 14 part-time staff members who support a great variety of software packages used by all engineering students.

Technical support. The department has one full-time senior technician who also carries the title of system manager for the Mechanical Engineering Computing Facility. His time is divided about equally between general support for the Department's laboratories and management of the MECF. Part-time student help is hired to assist the technician with tasks that require manual labor and/or routine maintenance and housekeeping. At this time technical support is considered to be quite adequate.

Administrative/clerical support. The Department currently employs two administrative assistants and two secretaries. One of the administrative assistants is located in the Center for Computational Mechanics (CCM) and devotes up to half of her time to technical typing. The second spends full time managing the flow of work through the central office and assisting the chairman with budget planning and the monitoring and control of all the Department's financial operations. In the main office each staff member including the

chairman is equipped with a Macintosh computer that is connected to the departmental network.

LABORATORY FACILITIES

A. Summary of facilities

A summary of laboratory facilities is given in Table XIV (following section XV).

B. Assessment of equipment and instrumentation

- 1. Jolley B2, CAD-CAM Laboratory.** This well-equipped laboratory is more than adequate for the currently required student experiments in machine design (MAE 322A). With over 2000 sq. ft. of floor space it also serves as a base for graduate student research projects relating to mechanical design and manufacturing. The major items of equipment housed in the laboratory are listed in Section C, below.
- 2. Jolley 103, Materials Science Laboratory.** This laboratory is used for the laboratory portion of the required materials science course, ChE/MAE 325. The course is offered every semester. Instructional activity covers such basic topics as microstructural characterization, mechanical property testing, microhardness measurements, heat-treatment and precipitation hardening, cold working and annealing. The majority of the equipment and instrumentation presently available are rather old and definitely not of research quality. However, they are functioning reliably and are considered adequate for the teaching of basic principles of materials science.
- 3. Jolley 105, Internal Combustion Engines Laboratory.** The engine-test cell is very well equipped for the freshman elective course, MAE 147. It also serves as a base for sponsored research projects. Installed in the cell are four gasoline engines, one diesel engine, two dynamometers, and one PC computer for data acquisition. In addition, there is a Sun exhaust emission analyzer. Outside the cell is an open bay with garage door entrance. This space has been heavily used by student teams working on competitive automotive projects such as the HEV car.
- 4. Jolley 110, Machine Design Laboratory.** This laboratory is furnished as a design space where groups of students enrolled in machine design (MAE 322A) courses can carry out computational work, make drawings and assemble reports. It contains six IBM-type PCs, a CalComp plotter, and 15 large, drafting size tables. The laboratory is adequate for these activities.
- 5. Jolley 111, Vibration and Dynamics Laboratory.** This laboratory houses the experimental apparatus used by students in the required vibrations course, MAE 417. It is also used for demonstrations in two graduate courses, Theory of Vibrations (MAE 522) and Analytical Mechanics (MAE 502). Present equipment permits the students to gain hands-on experience in vibrations of real devices with single and multi degrees of freedom, in Fourier analysis of periodic signals, and in modal analysis. The laboratory contains a variety of electronic instrumentation and transducers, an electromagnetic shaker, and two Mac SE microcomputers for automated data acquisition and signal processing. Because of limited space and experiment set-ups the laboratory can only accommodate two groups of three students at a time.

6. **Jolley 314, Thermal Science Laboratory.** This laboratory was established after the move to Jolley Hall in 1990. It serves quite adequately as the base for the required heat-transfer laboratory course (MAE 372B) which runs every semester. The laboratory presently houses one station each of six basic experiments. The exercises are designed to give the students hands-on experience with the three basic modes of heat transfer while introducing them to important modern technology, such as the heat pipe, hot-wire anemometer, infrared pyrometer, heat exchanger, vortex tube, and thermocouple.
7. **Urbauer 320, Fluid Mechanics Laboratory.** This is the Department's largest laboratory, in terms of floor area (2190 sp. Ft.), but a large part of the area is taken up by a wind tunnel. In addition to this tunnel there is a self-contained, open channel flow apparatus, a fixed pipe-flow system, and a mobile bench-top circuit for testing performance of a centrifugal pump, all of which are used for student experiments in the fluid mechanics laboratory course, CE/MAE 372A. This course is required for all mechanical and civil engineers, and the laboratory comfortably processes up to 100 students during the fall semester. This laboratory is considered to be adequately equipped, but plans are underway to upgrade some of the instrumentation and data-acquisition hardware presently dedicated to the wind-tunnel activity.

Plans for continued updating and development.

The following paragraphs are excerpted from the Department's laboratory management plan.

1. **Faculty oversight.** Each of the instructional laboratories has a designated faculty director who is responsible for (i) monitoring the condition of the laboratory space and its equipment, (ii) arranging for the timely repair and/or replacement of equipment, and (iii) recommending the acquisition of new equipment. Each director is also responsible for coordinating the scheduling of instructional activities in his or her laboratory. The six directors (named in Section XI-C, above) plus other interested faculty members and the department chairman, *ex officio*, constitute the **Instructional Laboratory Committee**. The Instructional Laboratory Committee will convene at least once each semester to review the state of the laboratories, discuss general pedagogical and operational problems and procedures, and recommend improvements. The committee is responsible for defining and prioritizing the needs for new equipment and/or renovation of physical facilities.
2. **Technical support.** The Department staff includes a senior technician who provides general administrative and technical assistance to the faculty directors in the discharge of their oversight responsibility. The technician is responsible for the troubleshooting of routine mechanical and electrical problems, minor repairs on site, and coordination with the Engineering Machine Shop and the University's Physical Facilities Department when necessary. He is also available to supervise student laboratory assistants while instructional exercises are in progress. The technician keeps an inventory of the major items of equipment in each laboratory and cooperates with the University's Assets Records Office in the regular updating of these inventories. The technician monitors the cleanliness of the laboratories and arranges for special cleaning services when necessary.
3. **Financial Support.** The Department provides necessary financial support for the instructional laboratories from its budget and from separately endowed funds organized specifically for laboratory support. Unrestricted cash donations are usually channeled to laboratory needs. To respond to needs of larger scale, the Department regularly seeks

additional funding from industry and government agencies. In addition, a portion of the income from our program with the Univ. of Missouri, St. Louis, is dedicated to labs.

Maintenance and servicing of laboratory equipment

As explained in the discussion of the laboratory plan, the monitoring, maintenance and servicing of laboratory equipment is the responsibility of the Department's Senior Engineering Technician, Mr. James E. Bulfin. Mr. Bulfin is an experienced and extraordinarily versatile technician. He has an extensive background in computer science and also serves as the System Manager of the Mechanical Engineering computing Facility. During the academic year graduate teaching assistants and undergraduate work-study students are assigned to work under Mr. Bulfin's supervision in the instructional laboratories.

Criterion 7. Institutional Support and Financial Resources.

Washington University provides to UM-St. Louis what is essentially a "turnkey" upper-division engineering program, the UM-St. Louis/Washington University Joint Undergraduate Engineering Program. All upper-division engineering courses and laboratories in our Joint Program with UM-St. Louis are held on the Washington University campus, not on the UM-St. Louis campus. Joint Program students are taught by the same engineering faculty members in the same classrooms and laboratories as the Washington University undergraduates. In nearly all the courses they take, Joint Program students are actually learning engineering alongside the Washington University students in the same classrooms and laboratories. Joint Program students hear the same lectures, perform the same laboratory and group project exercises (very often with Washington University students as their partners), do the same homework, take the same examinations, and are graded on the same scale as the Washington University engineering undergraduates in civil, mechanical, and electrical engineering. Joint Program students rely on the Washington University libraries and computing facilities and even use The Career Center at Washington University for their job searches.

To support that activity, UM-St. Louis pays an annual fee to the School of Engineering and Applied Science at Washington University. A portion of that fee is included in the operating appropriations shown for each of the three departments that participate in the Joint Program: civil engineering, electrical and systems engineering, and mechanical and aerospace engineering. Because these two student populations are essentially fully integrated insofar as their engineering education is concerned, we make to attempt to do a separate cost accounting for each population.

Criterion 8. Program Criteria.

The ASME Program criteria for Mechanical Engineering are as follows:

1. *Curriculum*

The program must demonstrate that graduates have: Knowledge of chemistry and calculus-based physics with depth in at least one; the ability to apply advanced mathematics through multivariate calculus and differential equations; familiarity with statistics and linear algebra; the ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems.

2. Faculty

The program must demonstrate that faculty responsible for the upper-level professional program are maintaining currency in their specialty area.

Curriculum

Prior to being formally admitted into the Joint ME Program the students will have taken the following courses as part of the admission process:

Chemistry I (3 units), Chemistry II (3 units), Chemistry Lab (2 units), calculus-based Physics I (4 units) and Physics II (4 units) and Differential Equations (3 units) are taken in order to establish their knowledge base in chemistry and physics and differential equations.

Upon admission to the Joint ME Program, they take the required mathematics course Engineering Mathematics JEMT 3170 (4 units) which covers multivariate calculus and linear equations. A course required of all Mechanical Engineering students, JEMT 3260, covers both probability and statistics.

Mechanical Engineering has four basic stems: 1) thermal and fluid sciences, 2) dynamics and control, 3) mechanics and material science, and 4) mechanisms and design.

In the thermal fluid stem, required courses are:

Thermodynamics	JME 3200	3 units
Energetics	JME 3210	3 units
Fluid Mechanics	JME 3700	3 units
Fluid Mechanics Lab	JME 3721	1 unit
Heat Transfer	JME 3710	3 units
Heat Transfer Lab	JME 3722	<u>1 unit</u>
	Total:	14 units

In the dynamics and control stem, required courses are:

Dynamics	ENG 2320	3 units
Vibrations I	JME 4170	2 units
Vibrations II	JME 4180	2 units
Control Systems	JME 4310	<u>3 units</u>
	Total:	10 units

In the mechanics and materials stem, required courses are:

Statics	ENG 2310	3 units
Deformable Bodies	JME 2410	3units
Machine Design	JME 3221	3 units
Material Science	JME 3250	<u>4 units</u>
	Total:	13 units

In the design stem, required courses are:

Introduction to Design & CAD	JME 1413	2 units
Introduction to Design project	JME 1414	2 units

Senior Design Project	JME 4040	5 units
Current Topics in Design	JME 4041	<u>1 unit</u>
	Total:	10 units

It has been observed that it was possible for a student to go through the program without having earned design units in the thermal stem if he or she would not be involved in a thermal design project in JME 4040 or have design credits in the 12 units of upper-division electives. To close this loophole, the Undergraduate Committee has added 0.5 units of design in both Energetics JME 3210 and the Heat Transfer Lab JME 3722. In JME 3210 this is accomplished by adding design in both lecture and homework assignments involving open-ended design problems. Prof. Gardner has already been successful in adding design to the day-school heat transfer lab and this will be carried over into JME 3722. This will guarantee that graduates will have *“the ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems.”* With the addition of this extra unit of design all students in the Joint ME Program will earn a minimum of 17.25 units of design. From our experience students generally add 1-3 extra units of design when they take the 12 units of upper-division electives like JME 4810 or JME 4820.

Faculty Resumes

Appendix I-C lists the resume of each faculty member directly involved with the Joint ME Program. Full-time faculty maintain their currency by their research efforts which result in technical meeting presentation and publication of results in peer-reviewed scientific journals. Affiliate faculty work full time in professional positions in the St. Louis area. Their work experience is part of the reason why they were appointed to their part-time position to teach at the university. For example, if they work for Boeing, they might teach fluids, thermodynamics, vibrations or control systems in the program. Currency in their area of their specialty is a prerequisite for both positions. The resumes of full-time and part-time faculty in the Joint ME Program demonstrate they are current in their areas of specialization.

Further information available at the time of the ABET visit:

- Student internal records
- Student Analyzer records
- Visit with current students
- Visit with faculty members

Criterion 9. Cooperative Education.

Not applicable.

Criterion 10. General Advanced-Level Program.

Not applicable.

APPENDIX I – A

Additional Program Information

Tabular Data for Program
Table 1. Basic-Level Curriculum
(Mechanical Engineering)

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Sciences	Engineering Topics	General Education.	Other
			Check if Contains Design (✓)		
1 st Year	English 1100		()	3	
	Physics I	5	()		
	Calculus I	5	()		
	JME1413, Intro to Engr. Design CAD	2	(✓)		
	JME 1414, Intro to Engr. Design, Project	2	(✓)		
	Humanities/social sciences elective		()	3	
	Physics II	5	()		
2 nd Year	Calculus II	5	()		
	Humanities/social sciences elective		()	6	
	General Chemistry I	5	()		
	Calculus III	5	()		
	Differential Equations	3	()		
	Engineering 2310, Statics		3 ()		
	JEE 2300, Intro to Electrical Networks		3 (✓)		
	General Chemistry II	5	()		
	JEMT 3170, Engineering Mathematics	4	()		
	Engineering 2320, Dynamics		3 ()		
	JCS 1002, Intro to Computing Skills MATLAB		1 ()		
	JCS 1260, Intro to Computer Programming		3 ()		
	3 rd Year	JEMT 3260, Probability & Statistics	3	()	
JME 2410, Mechanics of Deformable Bodies			3 ()		
JME 3200, Thermodynamics			3 ()		
JME 3250, Materials Science			4 ()		
JME 3700, Fluid Mechanics			3 ()		
JME 3210, Energetics for Mechanical Engineers			3 ()		
JME 3221, Intro to Machine Design			4 (✓)		
JME 3721, Fluid Mechanics Lab			1 ()		
JME 3710, Principles of Heat Transfer			3 ()		

(continued on next page)

**Table 1. Basic-Level Curriculum (continued)
(Mechanical Engineering)**

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)				
		Math & Basic Science	Engineering Topics Check if Contains Design (✓)	General Education	Other	
3 rd Year			()			
	JEC 3100, Engineering Communications		()		3	
4 th Year	Humanities/social sciences elective		()	3		
	JME 4170, Dynamic Response		2 (✓)			
	JME 4180, Dynamic Response Lab		2 (✓)			
	JME 3722, Heat Transfer Lab		1 ()			
	JME 4040 ME Design Project		5 (✓)			
	Mechanical engineering electives		6 ()			
	Humanities/social sciences elective		()	3		
	JEE 2330, EE lab		3 (✓)			
	JME 4310, Control Systems		3 (✓)			
	Mechanical engineering electives		6 ()			
	Humanities/social sciences elective		()	3		
	JME 4041, ME Topics		1 (✓)			
	Government/Diversity		()	4		
				()		
				()		
			()			
			()			
			()			
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		49	66	25	3	
OVERALL TOTAL FOR DEGREE		143				
PERCENT OF TOTAL (Based on 127 sem credit hrs)		31%	49%	18%	2%	
Totals must satisfy one set	Minimum semester credit hours	32 hrs	48 hrs			
	Minimum percentage	25%	37.5 %			

**Table 2. Course and Section Size Summary
(Mechanical Engineering)**

Course No.	Title	No. of Sections offered in Current Year	Avg. Section Enrollment	Type of Class (1)			
				Lecture	Laboratory	Recitation	Other
JME1414	Intro. to Engineering Design	5	4		100%		
JME 2410	Mechanics of Deformable Bodies	3	13	100%			
JME 3200	Thermodynamics	1	26	100%			
JME 3210	Energetics for Mechanical Engineers	2	6	100%			
JME 3221	Mechanical Design & Machine Elements	1	9	75%	25%		
JME 3250	Material Science for JME	2	7	75%	25%		
JME 3360	Materials Science for JCE	1	11	100%			
JME 3611	Materials Engineering	1	9	100%			
JME 3700	Fluid Mechanics	2	14	100%			
JME 3710	Principles of Heat Transfer	1	15	100%			
JME 3721	Fluid Mechanics Lab	1	22		100%		
JME 3722	Heat Transfer Lab	1	13		100%		
JME 3750	Fluid Control & Power Systems: Theory & Practice	1	22	100%			
JME 4040	Senior Design Project	1	6	10%	90%		
JME 4041	Engineering Design Topics	2	10	100%			
JME 4170	Dynamic Responses of Physical Systems	2	5	100%			
JME 4180	Dynamic Response Laboratory	2	5		100%		
JME 4250	Materials in Engineering Design	1	1	100%			
JME 4310	Control Systems I	2	13	100%			
JME 4490	Sustainable Air Quality	1	1	100%			
JME 4530	Facilities Design	1	2	100%			
JME 4810	Air Conditioning Systems and Equipment I	1	7	100%			
JME 4820	Air Conditioning Systems and Equipment II	1	12	100%			

**Table 3. Faculty Workload Summary
(Mechanical Engineering)**

Faculty Member (Name)	FT or PT	Classes Taught (Course No./Credit Hrs.) Academic Year 2005	Total Activity Distribution		
			Teaching	Research	Other
R.K. Agarwal	FT	MAE 163 (3), MAE 370 (3), MAE 380 (3)	25	50	25
R. Axelbaum	FT	MAE 321 (3), MAE 448A (3), MAE 564 (3)	25	50	25
P. Bayly	FT	MAE 417 (3)	25	50	25
D.C. Chen	FT	MAE 163 (3), MAE 370 (3), MAE 563 (3)	50	50	
E. Fried	FT	MAE 320 (3), MAE 416 (3)	50		50
R.A. Gardner	FT	MAE 371 (3) JME 3722 (1), MAE 372B (1)	50		50
G. Genin	FT	MAE 232 (3), MAE 416 (3)	25	50	25
R. Husar	FT	MAE 449 (3)	10	65	25
M. Jakiela	FT	MAE 141D (2), MAE 322A (4)	50	25	25
K.L. Jerina	FT	MAE 204 (3), MAE 433 (3), MAE 5904 (3)	25	50	25
R.J. Okamoto	FT	404P (5)	25	50	25
D.A. Peters	FT	MAE 505(3), MAE 522 (3)	25	25	50
S. Sastry	FT	MAE 325 (4), JME 3250 (3), MAE 361A (3), MAE 655 (3), MAE 657 (3)	50	35	15
A. Shen	FT	MAE 320 (3), MAE 652A (3)			
M. Swartwout	FT	404P (4), MAE 190 (3), MAE 201 (3), MAE 301 (3)	25	50	25
B. Szabo	FT	MAE 241 (3), MAE 546 (3)	25	50	25
R. Actis	PT	MAE 241 (3), JME 2410 (3), MAE 489 (3)	100		
X. Avula	PT	JME 3221 (3), MAE 5902 (3), MAE 5903 (3)	100		
C. Bagget	PT		50		50

**Table 3. Faculty Workload Summary (continued)
(Mechanical Engineering)**

Faculty Member (Name)	FT or PT	Classes Taught (Course No./Credit Hrs.) Academic Year 2005	Total Activity Distribution		
			Teaching	Research	Other
T. Bever	PT	JME 4040 (1), JME 4041(1), MAE 404T (1)	100		
H. Brandon	PT	JME 3210 (3), JME 4440 (3), MAE 581 (3), MAE 582 (3)	50	50	
A. Cary	PT	MAE 535 (3)			
J. Craig	PT	MAE 141C (2)	100		
Dyer	PT	MAE 488A (3)	100		
Gaffney	PT	MAE 149 (2)	100		
J. Georgian	PT		100		
M. Gomez	PT	JME 425 (3), MAE 575 (3),	100		
H. Gross	PT	MAE 590Y (3)	100		
Guo	PT	MAE 265 (3)	100		
R. Hakkinen	PT	MAE 372A, JME 3721 (1) MAE533 (3), MAE534 (3)	50	25	25
P. Harkins	PT	MAE 143A (2)			
Holtzman	PT	MAE 533 (3)	100		
D. C. Look	PT	MAE 530 (3), JME 3200 (3)	100		
P. Paris	PT	MAE 502 (3)	75	25	
D. Pitt	PT	JME 4170 (2), JME 4180 (2)	100		
C. Spuhl	PT	JME 4310 (3)	100		
M. Wendl	PT	JME 3700 (2), JME 3710 (2)	100		

**Table 4. Faculty Analysis
(Mechanical Engineering)**

Name	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned	Years of Experience			Professional Registration (Indicate State)	Level of Activity (high, med, low, none) in:		
					Govt./Industry Practice	Total Faculty	This Institution		Professional Society	Research	Consulting/Summer Work in Industry
R.K. Agarwal	Prof	FT	PhD	Stanford 1975	10	12	5	non	AIAA, ASME	high	high
R. L. Axelbaum	Assoc. Prof.	FT	Ph.D	UC Davis 1988	8	19	16	EIT	ASME	high	high
P.V. Bayly	Prof	FT	PhD	Duke Univ. 1993	4	12	12	none	ASME	high	med
D.C. Chen	Assoc Prof	FT	PhD	Univ. of Minn. 1997	0	13	4	none	ASME	high	med
E. Fried	Prof	FT	PhD	Cal Tech 1991	0	17	4	none	ASME	high	low
R.A. Gardner	Prof	FT	PhD	Purdue 1969	0	31	29	Missouri, Montana	ASME, AIAA med	low	low
G. M. Genin	Asst. Prof.	FT	PhD	Harvard 1997	0	7	7	none	ASCE, ASME, AAM	high	med
R. Husar	Prof	FT	PhD	Univ. of Minn. 1971	3	33	33	none	ASME	high	med
M. Jakiela	Prof	FT	PhD	Univ. of Mich. 1971	0	18	10	none	ASME	med	high
K.L. Jerina	Prof.	FT	DSc	Washington Univ 1974	7	27	24	Texas	ASME med ASTM med	high	low
R. Okamoto	Asst. Prof.	FT	PhD	Washington Univ 1997	6	9	9	EIT	ASME, BMES	high	none
D.A. Peters	Prof.	FT	PhD	Stanford 1974	6	25	19	Missouri, Georgia	AHS, AIAA, ASME, high	high	high
S.M.L. Sastry	Prof.	FT	PhD	Univ. of Toronto 1974	17	21	20	none	TMS, ASM, MRS high	high	med
A. Shen	Asst. Prof.	FT	PhD	Univ. of Ill 2000	0	3	3	none	ASME	high	low
M. Swartwout	Asst. Prof.	FT	PhD	Stanford 2000	0	7	7	none	AIAA	med	low

**Table 4. Faculty Analysis (continued)
(Mechanical Engineering)**

Name	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned	Years of Experience			Professional Registration (Indicate State)	Level of Activity (high, med, low, none) in:		
					Govt./Industry Practice	Total Faculty	This Institution		Professional Society	Research	Consulting/Summer Work in Industry
B. Szabo	Prof	FT	PhD	SUNY Buffalo 1966	7	34	32	Missouri	ASME	high	high
R. Actis	Affil.	PT	DSc	Washington Univ 1991	19	26	15	none			high
X. Avula	Res. Prof.	PT	PhD	Iowa State Univ 1968	7	34	3	Missouri	ACM ASME	med med	
C. Bagget*	Adj Prof	PT									
T. Bever	Adj Prof	PT	BS	Washington Univ	48	15	15	Missouri	ASME	high	high
H.J. Brandon	Affil. Prof.	PT	DSc	Washington Univ 1969	29	37	27	Missouri	ASME med	med	high
J.W. Craig	Affil. Prof.	PT	MSED	Kansas State 1973	6	48	18	none	ASEE med	med	low
Dyer*	Adj Prof	PT									
M. Gaffney	Adj Prof	PT	MBA	St. Louis Univ 1981	25	2	2	none			
J. Georgian	Adj Prof	PT	MS	Cornell Univ. 1941	15	63	57	Missouri	ASME, ASEE, AAUP	low	low
M.P. Gomez	Affil. Prof.	PT	PhD	Stanford 1964	35	22	31	Missouri	ASTM low	low	high
H. Gross*	Adj Prof	PT									
X. Guo	Adj Prof	PT	PhD	Univ. of Maryland 1992	10	2	2	none			
R.J. Hakkinen	Prof.	PT	PhD	Caltech 1954	37	11	9	none	AIAA med APS med	low	med
A. Holtzman*	Adj Prof	PT									

**Table 4. Faculty Analysis (continued)
(Mechanical Engineering)**

Name	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned Year	Years of Experience			Professional Registration (Indicate State)	Level of Activity (high, med, low, none) in:		
					Govt./Industry Practice	Total Faculty	This Institution		Professional Society	Research	Consulting/Summer Work in Industry
D.C. Look	Adj Prof	PT	PhD	Univ. of Oklahoma. 1969	3	46	3	none	AIAA, ASEE, ASME, MAS, SPIE		
P. Paris	Prof	PT	PhD	Lehigh Univ 1962	39	53	30	none	ASTM		high
D. Pitt	Affil.	PT	DSc	Washington Univ 1980	36	19	10	Missouri	ASME, AIAA, AHS		high
C. Spuhl	Affil.	PT	M.S. M.E.	St. Louis Univ. 1970	42	16	16	Missouri	AIAA IMAGE		high
M. Wendl	Affil.	PT	DSc	Washington Univ 1994	5	15	7	EIT			high

*Will be provided Fall 2006

Table 5. Support Expenditures
(Mechanical Engineering)

Fiscal Year	1	2	3	4
	(prior to previous year)	(previous year)	(current year)	(year of visit)
Expenditure Category	2003-04	2004-05	2005-06*	2006-07*
Operations (1) (not including staff)	162,000	147,000	162,000	170,000
Travel (2)	31,000	21,000	27,000	28,000
Equipment (3)	178,000	151,000	173,000	182,000
(a) Institutional Funds	2,000	2,000	2,000	2,000
(b) Grants and Gifts (4)	176,000	149,000	171,000	180,000
Graduate Teaching Assistants	100,200	152,900	211,300	211,300
Part-time Assistance (5) (other than teaching)				

Instructions:

Report data for the engineering unit(s) and for each engineering program being evaluated. Updated tables are to be provided at the time of the visit.

Column 1: Provide the statistics from the audited account for the fiscal year completed 2 years prior to the current fiscal year.

Column 2: Provide the statistics from the audited account for the fiscal year completed prior to your current fiscal year.

Column 3: This is your **current fiscal year** (when you will be preparing these statistics). Provide your preliminary estimate of annual expenditures, since your current fiscal year presumably is not over at this point.

Column 4: Provide the budgeted amounts for your next fiscal year to cover the fall term when the ABET team will arrive on campus.

Notes:

- Categories of general operating expenses to be included here.
- Institutionally sponsored, excluding special program grants.
- Major equipment, excluding equipment primarily used for research. Note that the expenditures (a) and (b) under "Equipment" should total the expenditures for Equipment. If they don't, please explain.
- Including special (not part of institution's annual appropriation) non-recurring equipment purchase programs.
- Do not include graduate teaching and research assistant or permanent part-time personnel.

*Estimates - updated tables will be provided prior to Fall 2006 visit.

Washington University provides to UM-St. Louis what is essentially a "turnkey" upper-division engineering program, the UM-St. Louis/Washington University Joint Undergraduate Engineering Program. All upper-division engineering courses and laboratories in our Joint Program with UM-St. Louis are held on the Washington University campus, not on the UM-St. Louis campus. Joint Program students are taught by the same engineering faculty members in the same classrooms and laboratories as the Washington University undergraduates. Joint Program students rely on the Washington University libraries and computing facilities and even use The Career Center at Washington University for their job searches.

To support that activity, UM-St. Louis pays an annual fee to the School of Engineering and Applied Science at Washington University. A portion of that fee is included in the operating appropriations shown for each of the three departments that participate in the Joint Program: civil engineering, electrical and systems engineering, and mechanical and aerospace engineering. Because these two student populations are essentially fully integrated insofar as their engineering education is concerned, we make no attempt to do a separate cost accounting for each population.

Appendix I –B
Additional Program Information
Course Syllabi*

*Syllabi for all the required non-engineering courses can be found in Appendix II.

COURSE INFORMATION SHEET
ENGR 2310 – STATICS
FALL 2004

CLASS SCHEDULE: Mondays and Wednesdays, 11:00AM-12:15PM

INSTRUCTOR: Jonathan Sigman, PE
Jonsig13@yahoo.com

OFFICE HOURS: B-236; x-6804
Monday and Wednesday, 12:30-1:30 PM
and by appointment

COURSE DESCRIPTION:

Solving engineering problems involving particle and systems in equilibrium via the principles of mechanics. Topics to be covered include: statics of particles and rigid bodies. Equivalent systems of forces. Distributed forces: centroids. Applications to trusses, frames, machines, beams and cables. Friction. Moments of inertia. Principle of virtual work and applications.

COURSE OBJECTIVE:

To apply the principles of mechanics and equilibrium to engineering situations.

COURSE INFORMATION:

There will be readings that correspond to each lecture. It would be good if you did them ahead of time. There will be one problem set handed out per week. Homework will be collected and graded. While everything in life may be negotiable, homework must be turned in on its due date, unless discussed with me ahead of time. It is also expected that you attend lecture. If you **MUST** be absent, please inform me ahead of time. Or at least let me know afterwards why you missed lecture. Habitual absence will rear its ugly head on your final grade.

TEXT:

Engineering Mechanics: Statics by R.C. Hibbeler, 10th ed., published by Prentice Hall.

COURSE PREREQUISITE:

MATH 1900 – Analytic Geometry and Calculus II; PHYS 2111 – Physics: Mechanics and Heat

GRADING:

Tests:	50%
Final:	25%
Homework:	15%
Quizzes/Participation:	10%

TESTS:

Tests and pop quizzes will be open book and closed notes. Quizzes may be given at any time. Show all work – partial credit will be given. Please approach me as soon as possible if you require any special testing arrangements or if you absolutely cannot make a test.

You WILL need a calculator for the exams. Graphing calculators and calculators with stored formulas may not be used.

Make up tests will only be given if there is a prior arrangement. Make up tests must be taken within one week of the original exam. Arrangements will be made with the Campus Assessment Center to administer the test.

CLASS POLICIES:

In accordance with college policy, this class will be a smoke, food, and drink-free zone. Sorry. If you REALLY need your morning Starbucks, we can discuss it.

Please shut off cellular phones and beepers during class.

I will do everything in my power to get to class on time, please try to do the same. But you are still encouraged to come to class if you are late.

Students requiring special accommodations should meet with me during office hours so we can discuss how to meet your needs this semester. Prior to our meeting, be sure to meet with someone in disability Access Services (MSC 144).

TENTATIVE SCHEDULE

Week	Topics	Assignments
1	General Principles/Force Vectors	
2	Force Vectors	PS 1 out
3	Equilibrium of a Particle	PS 1 in; PS 2 out
4	Labor Day ! / Equilibrium of a Particle	PS 2 in; PS 3 out
5	Force Systems Resultants	Test 1 – Wed 9/15
6	Force Systems Resultants	PS 3 in; PS 4 out
7	Equilibrium of a rigid body	PS 4 in; PS 5 out
8	Equilibrium of a rigid body	PS 5 in; PS 6 out
9	Structural Analysis	PS 6 in; PS 7 out
10	Structural Analysis	TEST 2 – Wed 10/18
11	Internal Forces	PS 7 in; PS 8 out
12	Friction	PS 8 in; PS 9 out
13	Center Gravity and Centroid	PS 9 in; PS 10 out
14	Moments of Inertia	TEST 3 - /Wed 11/17
15	Moments of Inertia/Thanksgiving	PS 10 in
16	Virtual Work	PS 11 out
17	Review	PS 11 in

COURSE INFORMATION SHEET
ENGR 2320 – DYNAMICS
FALL 2004

CLASS SCHEDULE: Mondays and Wednesdays, 9:30-10:45 AM

INSTRUCTOR: Jonathan Sigman, PE
Jonsig13@yahoo.com

OFFICE HOURS: B-236; x-6804
Monday and Wednesday, 12:30-1:30 PM
and by appointment

COURSE DESCRIPTION:

Solving engineering problems involving particle and rigid body motion via the principles of mechanics and kinetics. Topics to be covered include: review of vector algebra and calculus. Kinematics of a particle. Newtown's laws and the kinetics of a particle. Work and energy. Impulse and momentum. Kinematics of rigid bodies. General theorems for systems of particles. Kinetics of rigid bodies. The inertia tensor.

COURSE OBJECTIVE:

To apply the principles of mechanics and kinetics to engineering situations.

COURSE INFORMATION:

There will be readings that correspond to each lecture. It would be good if you did them ahead of time. There will be one problem set handed out per week. Homework will be collected and graded. While everything in life may be negotiable, homework must be turned in on its due date, unless discussed with me ahead of time. It is also expected that you attend lecture. If you MUST be absent, please inform me ahead of time. Or at least let me know afterwards why you missed lecture. Habitual absence will rear its ugly head on your final grade.

TEXT:

Engineering Mechanics: Dynamics by R.C. Hibbeler, 10th ed., published by Prentice Hall.

COURSE PREREQUISITE: ENGR 2310 – Statics

GRADING:

Tests:	50%
Final:	25%
Homework:	15%
Quizzes/Participation:	10%

TESTS:

Tests and pop quizzes will be open book and closed notes. Quizzes may be given at any time. Show all work – partial credit will be given. Please approach me as soon as possible if you require any special testing arrangements or if you absolutely cannot make a test.

You WILL need a calculator for the exams. Graphing calculators and calculators with stored formulas may not be used.

Make up tests will only be given if there is a prior arrangement. Make up tests must be taken within one week of the original exam. Arrangements will be made with the Campus Assessment Center to administer the test.

CLASS POLICIES:

In accordance with college policy, this class will be a smoke, food, and drink-free zone. Sorry. If you REALLY need your morning Starbucks, we can discuss it.

Please shut off cellular phones and beepers during class.

I will do everything in my power to get to class on time, please try to do the same. But you are still encouraged to come to class if you are late.

Students requiring special accommodations should meet with me during office hours so we can discuss how to meet your needs this semester. Prior to our meeting, be sure to meet with someone in disability Access Services (MSC 144).

TENTATIVE SCHEDULE

Week	Topics	Assignments
1	Introduction/Rectilinear Motion	
2	Erratic/Curvilinear/Projectile Motion	PS 1 out
3	Normal, Tangential, Cylindrical Components	PS 1 IN; PS 2 out
4	Labor Day ! / Dependent Motion	PS 2 in; PS 3 out
5	Relative Motion	Test 1 – Wed 9/15
6	Newton’s Laws, Equations of Motion	PS 3 in; PS 4 out
7	Work and Energy/Power and Efficiency/ Conservation of Energy	PS 4 in; PS 5 out
8	Impulse and Momentum/Conservation Of linear Momentum/Impact	PS 5 in; PS 6 out
9	Angular Momentum/Angular Impulse	PS 6 in; PS 7 out
10	Rigid Body Translation and Rotation	TEST 2 – Wed 10/18
11	Relative Motion/Instantaneous Center of Zero Velocity	PS 7 in; PS 8 out
12	Relative Motion: Acceleration/Rotating Axes	PS 8 in; PS 9 out
13	Mass Moment of Inertia/Equations of Motion	
14	Rotation	TEST 3 - /Wed 11/17
15	General Plan Motion / Thanksgiving	PS 10 in
16	Work and Energy/Impulse and Momentum	PS 11 out
17	Review	PS 11 in

JCS1002 Introduction to Computing Tools: MATLAB Skills

Required/Elective Course: Elective

Credit: 1 Unit

2004-2005 Catalog Data: This course is aimed at the acquisition of MATLAB skills through hands-on familiarization and practice. Students practice the array, vector, and mesh grid representations, use programming and plotting, and apply these skills to solve numerical problems and generate reports.

Prerequisite: None

Textbooks: N/A

Reference:

Coordinator: Ronald P. Loui, Associate Professor of Computer Science and Engineering

Course Objectives: By the end of this course, students should be comfortable and self-sufficient using Matlab.

Topics Covered:

1. Variables, Matrices
2. Calling functions
3. Plotting, 2D and 3D plotting
4. Writing functions
5. Debugging

Class/Lab Schedule: 1 session – 2 hours

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	1 credits or 100%

Relationship of Course to Program Outcomes:

The following outcomes are explicitly covered:
(k)

Prepared By: Roger Chamberlain

Prepared On: June 2006

JCS1260 Introduction to Computer Programming

Required/Elective Course: Elective

Credit: 3 Units

2004-2005 Catalog Data: This is a one-semester introduction to programming and using the object-oriented Java language. A structured approach to programming covers the software life cycle: problem definition, algorithm/program design and program coding and debugging. Topics include: abstraction, decomposition, classes and inheritance, applets, data structures, recursion, graphics, numerical computation, and simulation. Basic computer hardware and software architectures are briefly presented.

Prerequisite: The course assumes no previous programming experience.

Textbooks: Sanders, K. & van Dam, A., Object-Oriented Programming in Java: A Graphical Approach, Preliminary Edition, Addison Wesley, 2005.

Reference:

Coordinator: Paul Gross, Graduate Research Assistant in Computer Science

Course Objectives: The course provides an introduction to fundamental software concepts. It is ideal for students considering a major or minor in computer science, as well as for students who want to learn about computing for use in another discipline.

Topics Covered:

1. **Data Types and Expressions**
2. **Variables and Naming Abstraction**
3. **Procedural Abstraction**
4. **Instructions and Memory**
5. **Compilation and Execution**
6. **Compound Data**
7. **Documentation, Testing, and Debugging**
8. **Data Abstraction**
9. **Recursion and Recursive Algorithms**
10. **Iteration and Iterative Algorithms**
11. **Introduction to Data Structures**
12. **Introduction to Software Design**

Class/Lab Schedule: 2 sessions - 90 minutes per session plus 90 minute lab

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%

Relationship of Course to Program Outcomes:

The following outcomes are explicitly covered:

(a), (c), (e)

The following outcomes are mentioned with limited coverage:

(f), (g), (k)

Prepared By: Roger Chamberlain

Prepared On: June 2006

COURSE DESCRIPTION
JEC 3100. TECHNICAL WRITING
Fall Semester 2005 / Spring Semester 2006

2004 -- 2006 Catalog Data: EP 310-1,2,3,4,5,6,7,8,9: Technical Writing. Credit 3 units.

Persistent concerns of grammar and style. Analysis and discussion of clear sentence and paragraph structure and of organization in complete technical documents. Guidelines for effective layout and graphics. Examples and exercises stressing audience analysis, graphic aids, editing, and readability. Videotaped work in oral presentation of technical projects. Writing assignments include descriptions of mechanisms, process instructions, basic proposals, letters and memos, and a long formal report. Prerequisites: satisfaction of the English Composition proficiency requirement of SEAS and junior standing.

Textbook: Michael H. Markel, Technical Writing: Situations and Strategies, 7th edition, Bedford St. Martin's Press, 2004.

Reference: None

Coordinator: James C. Ballard, Associate Professor of Engineering and Policy. Director of Technical Communications.

Goals: This course seeks to develop the practical technical communication skills of junior and senior year engineering students who already possess adequate English proficiency. Proficiency should be demonstrated in written, graphic, and oral technical communication. Graduates of this course should have a career advantage in presenting their engineering work clearly and effectively.

Prerequisites by topic:

1. Prior satisfaction of the English Composition proficiency requirement of the School of Engineering and Applied Science.
2. Junior standing.

Topics:

1. Identifying and adapting to various audiences. (3 class-hours)
2. Grammar, sentence structure, mechanics, style, tone, editing. (6 class-hours)
3. Mechanism description. (5 class-hours)
4. Page design and graphics in technical communication. (4 class-hours)
5. Process description, instructions. (5 class-hours)
6. Proposals. (3 class-hours)
7. Memos, informal reports, letters. (7 class-hours)
8. Oral reports. (6 class-hours)
9. Resumes. (1 class-hour)
10. Formal reports. (5 class-hours)

Computer usage: All students use computers to execute their assignments.

Laboratory projects: Not applicable.

Estimated ABET category content: Engineering Science: 0 credits or 0%
Engineering Design: 0 credits or 0%
Other: 3 credits or 100%

Prepared by: J. C. Ballard

Date: June 7, 2006

**JEE 2300 - Introduction to Electrical Networks
Spring Semester 2005**

Required/Elective Course:	Required
Credit:	3 units
2004-2005 Catalog Data:	Elements, sources, and interconnects. Ohm's and Kirchhoff's laws, superposition and Thevenin's theorem; the resistive circuit, transient analysis, sinusoidal analysis, and frequency response.
Prerequisite:	Physics 2112 (UMSL)-Physics: Electricity, Magnetism, and Optics, Math 2020 (UMSL)-Introduction to Differential Equations
Textbooks:	J. W. Nilsson and S. A. Riedel, Electric Circuits, 7th ed., Addison-Wesley (required) J. W. Nilsson and S. A. Riedel, Introduction to PSpice: Manual Using OrCAD Release 9.2, (accompanies text)
Reference:	IEEE Standards Coordinating Committee 14, Standard for Use of the International System of Units (SI): The Modern Metric System [IEEE/ASTM SI 10-1997], Institute of Electrical and Electronics Engineers (recommended)
Coordinator:	R. Martin Arthur, Professor of Electrical and Systems Engineering
Course Objectives:	To provide the students with a working knowledge of elementary networks so that they may successfully analyze simple circuits and successfully execute simple designs.

Prerequisites by topic:

1. General Physics. Ohm's Law and related material.
2. Circuit theory and Kirchhoff's laws.
3. Direct current instruments.
4. College Algebra. Simultaneous linear equations.
5. Determinants.
6. Quadratic equations.
7. Complex numbers.
8. Logarithms.
9. Trigonometry. Basic identities.
10. Euler's theorem.
11. Calculus. Fundamental concepts.
12. Elementary differentiation and integration.
13. Taylor series.

Topics Covered:

1. Circuit variables and elements (4 lectures)
2. Kirchhoff's laws (2 lectures)
3. Simple resistive networks (2 lectures)

4. Fundamentals of node and mesh analysis (4 lectures)
5. Equivalent sources and superposition (2 lectures)
6. Behavior in the time domain: RL, RC, and RLC networks (5 lectures)
7. Rise-time, overshoot, ringing, and droop (2 lectures)
8. Behavior in the frequency domain: elements of phasor analysis (2 lectures)
9. Frequency response and resonance (2lectures)
10. Complex power (1 lectures)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: 2 midterm examinations, 1 final exam

Computer Usage: PSpice is used for some homework assignments

Laboratory:

1. DC Circuits - Measurement and Analysis (1 week)
2. The Oscilloscope and RC, RL and RLC Transient Analysis (2 weeks)
3. AC Circuits (1 week)
4. Characteristics of Periodic Waveforms (1 week)
5. Circuits Containing Inductance (1 week)
6. Bipolar Junction Transistor Characteristics (1 week)
7. Design of a Single Transistor Amplifier (2 weeks)
8. Power Supplies (1 week)
9. Operational Amplifiers (1 week)
10. TTL and CMOS Digital Logic Circuits (1 week)

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2.25 credits or 75%
Engineering Design:	0.75 credits or 25%

Relationship of Course to Program Outcomes:

- (a) Ability to apply math, science, and engineering;
- (c) Ability to design a system, component, or process to meet desired needs;
- (e) Ability to identify, formulate, and solve engineering problems.
- (k) Ability to use techniques, skills, and modern engineering tools in engineering practice;
- (l) Preparation for participation in industry, academia, or governmental laboratories.

Prepared By: R. Martin Arthur

Prepared On: 15 August 2005

JEE 2330 - Electrical and Electronic Circuits Laboratory
Spring Semester 2005

Required/Elective Course:	Required
Credit:	3 units
2004-2005 Catalog Data:	Lectures and laboratory exercises related to topics in introductory electrical networks and electronic circuits.
Prerequisite:	JEE2300-Introduction to Electrical Networks (Prerequisite); JEE2320-Introduction to Electronic Circuits (Co-requisite)
Textbooks:	Electrical And Electronic Circuits Laboratory, "Exercise Manual," edited by Dr. John D. Corrigan, Affiliate Professor, Washington University.
Reference:	J. W. Nilsson and S. A. Riedel, Electric Circuits, 7th ed., Prentice Hall; Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 5 th ed., Oxford University Press.
Coordinator:	John Corrigan, Affiliate Professor of Electrical and Systems Engineering
Course Objectives:	To provide students with a practical and theoretical knowledge of basic measurement techniques, network analysis and design, and electronic components and test instrumentation plus expertise in designing, executing, and reporting a laboratory exercise.

Prerequisites by topic:

1. Steady-state DC and AC circuit analysis,
2. Thevenin and Norton equivalent circuits,
3. RC, RL, and RLC circuit transient analysis,
4. Op-Amp, Semiconductor Diode, and Bipolar Junction Transistor Characteristics,

Topics Covered:

1. DC circuits and measurements - Use of multimeters, loading effects, current measurement using a voltmeter, Thevenin equivalent circuits (1 week)
2. Measurement of time-varying signals - Use of the oscilloscope, RC, RL and RLC circuit transient response, relays (2 weeks)
3. AC circuits - RC and RLC circuit steady state sinusoidal response, frequency response, Bode diagrams (1 week)
4. Periodic waveforms - Fourier series, DC and AC power, effective and RMS voltage, Parseval's equation (1 week)
5. Inductance and resonance - Models for imperfect inductors, series resonance, parallel resonance (1 week)
6. BJT transistors - Large signal characteristics, small signal characteristics (1 week)
7. Common emitter amplifier - Amplifier design, biasing, small signal model, frequency response, implications of design choices (2 weeks)
8. Power supplies - Half-wave and full-wave rectification, filtering, ripple, regulation (1 week)
9. Operational amplifiers - Inverting and non-inverting gain stages, summation, integration, differentiation, square and triangle wave generation (1 week)

10. Electrical properties of TTL and CMOS digital logic inverter circuits - Voltage swing, voltage transfer characteristics, delay time, noise margin, power consumption (1 week)

Class/Lab Schedule: 2 sessions/week: 90 minutes lecture, 180 minutes laboratory

Tests: 1 midterm and 1 final exam

Computer Usage: Laboratory computers are used to collect screen images from the oscilloscopes. PSpice is used for circuit analysis. Students are encouraged (but not required) to use MATLAB or Excel for data analysis (e.g., graphing) and word processing for report generation.

Laboratory:

1. DC Circuits - Measurement and Analysis (1 week)
2. The Oscilloscope and RC, RL and RLC Transient Analysis (2 weeks)
3. AC Circuits (1 week)
4. Characteristics of Periodic Waveforms (1 week)
5. Circuits Containing Inductance (1 week)
6. Bipolar Junction Transistor Characteristics (1 week)
7. Design of a Single Transistor Amplifier (2 weeks)
8. Power Supplies (1 week)
9. Operational Amplifiers (1 week)
10. TTL and CMOS Digital Logic Circuits (1 week)

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	0 credits or 0%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	3 credits or 100%
Engineering Science:	2 credits or 67%
Engineering Design:	1 credits or 33%

Relationship of Course to Program Outcomes:

- (a) Ability to apply math, science, and engineering;
- (b) Ability to: design & conduct experiments; analyze and interpret data;
- (c) Ability to design a system, component, or process to meet desired needs;
- (d) Ability to function on multi-disciplinary teams;
- (e) Ability to identify, formulate, and solve engineering problems;
- (f) Understanding of professional and ethical responsibility;
- (g) Ability to communicate effectively;
- (h) Understanding of the global and societal role of engineering;
- (i) Recognition of need for and ability to engage in lifelong learning;
- (j) Knowledge of contemporary issues;
- (k) Ability to use techniques, skills, and modern engineering tools in engineering practice;
- (l) Preparation for participation in industry, academia, or governmental laboratories

Prepared By: John Corrigan

Prepared On: 8/11/05

JEM 3170 - Engineering Mathematics
Spring Semester 2005

- Required/Elective Course:** Required
- Credit:** 4 units
- 2004-2005 Catalog Data:** The Laplace transform and applications; series solutions of differential equations, Bessel's equation, Legendre's equation, special functions; matrices, eigenvalues, and eigenfunctions; vector analysis and applications; boundary value problems and spectral representations; Fourier series and Fourier integrals; solution of partial differential equations of mathematical physics.
- Prerequisite:** Math 2020 (UMSL)-Introduction to Differential Equations or equivalent.
- Textbooks:** E. Kreyszig, Advanced Engineering Mathematics, (8th edition), Wiley & Sons, 1999.
- Reference:** F.B. Hildebrand, Advanced Calculus for Applications, Prentice-Hall, 1962.
- Coordinator:** I.N. Katz, Professor of Electrical and Systems Engineering
- Course Objectives:** This course provides engineering students with fundamental and advanced mathematical techniques for the solution of engineering and scientific problems.
- Prerequisites by topic:**
1. Differential and Integral Calculus; Ordinary Differential Equations.
- Topics Covered:**
1. Laplace transforms (4 classes)
 2. Power series & special functions (4 classes)
 3. Vectors and matrices (10 classes)
 4. Vector differential calculus (5 classes)
 5. Vector integral calculus (10 classes)
 6. Boundary-value problems for ODE's and Fourier series (7 classes)
 7. Partial differential equations (16 classes)
- Class/Lab Schedule:** 2 sessions; 120 minutes per session
- Tests:** 3 one hour exams, two hour final exam, all open book
- Computer Usage:** None

Laboratory: None

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	4 credits or 100%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	0 credits or 0%
Engineering Science:	0 credits or 0%
Engineering Design:	0 credits or 0%

Relationship of Course to Program Outcomes:

- (a) Ability to apply math, science, and engineering
- (e) Ability to identify, formulate, and solve engineering problems
- (l) Preparation for participation in regional industry

Prepared By: I. Norman Katz

Prepared On: 4/20/05

JEM 3260 – Engineering Probability
Spring Semester 2005

Required/Elective Course: Required

Credit: 3 units

2004-2005 Catalog Data: Study of probability and statistics together with engineering applications. Probability and statistics: random variables, distribution functions, density functions, expectations, means, variances, combinatorial probability, geometric probability, normal random variables, joint distribution, independence, correlation, conditional probability, Bayes theorem, the law of large numbers, the central limit theorem. Applications: reliability, quality control, acceptance sampling, linear regression, estimation, hypothesis testing. Examples are taken from engineering applications.

Prerequisite: Math 2000 (UMSL)-Analytic Geometry and Calculus III or equivalent

Textbooks: J.S. Milton and J.C. Arnold, Introduction to Probability and Statistics, McGraw Hill, Fourth edition, 2003.

Reference: None

Coordinator: I.N. Katz, Professor of Electrical and Systems Engineering

Course Objectives: To provide an introduction to probability theory and statistics and its applications for students in engineering.

Prerequisites by topic:

1. Elementary set theory
2. Differentiation, and integration
3. Infinite series/Taylor series
4. Two-dimensional calculus

Topics Covered:

1. Probability and combinatorics (2 classes)
2. Probability spaces (2 classes)
3. Discrete random variables and distributions (3 classes)
4. Continuous random variables and distributions (3 classes)
5. Reliability (2 classes)
6. Joint distributions (3 classes)
7. Sums of independent random variables (1 class)
8. Estimation (3 classes)
9. Testing (3 classes)

10. Linear regression (4 classes)

11. Quality control (2 classes)

Class/Lab Schedule: 2 sessions; 90 minutes per session

Tests: None

Computer Usage: None

Laboratory: None

Contribution of Course to Meeting the Professional Component:

Math and Basic Sciences:	1 credits or 33%
Humanities and Social Sciences:	0 credits or 0%
Engineering Topics:	2 credits or 67%
Engineering Science:	2 credits or 67%
Engineering Design:	0 credits or 0%

Relationship of Course to Program Outcomes:

- (a) Ability to apply math, science, and engineering;
- (e) Ability to identify, formulate, and solve engineering problems.
- (l) Preparation for participation in regional industry

Prepared By: I. N. Katz

Prepared On: August 5, 2005

COURSE DESCRIPTION
JME 1414. Introduction to Engineering Design
Spring Semester 2006

2005 Catalog Data : **JME 1414: Introduction to Engineering Design: Project.** An introduction to engineering design in the context of mechanical engineering. Students first complete a series of experiments that introduce physical phenomena related to mechanical engineering. Understanding is achieved by designing and building simple devices and machines. The course proceeds to a design contest in which the students design and build from a kit of parts a more significant machine that competes in a contest held at the end of the course. The course is open to all and is appropriate for anyone interested in mechanical devices, design, and the design process. Credit 2 units.

Textbook: None

Textbooks (Recommended): None

Textbooks (Reference): Any of the many lay books introducing mechanical devices and machines. One example is McCauley's How Things Work

Coordinator: Mark Jakiela, Hunter Professor of Mechanical Design.

Goals: To provide an experiential introduction to mechanical design and the subtopics of mechanical engineering. To provide a brief review of basic physics using actual devices. To provide the opportunity to to design and build a working device.

Prerequisites by topic: None

Topics:

1. Introductory statics
2. Introductory dynamics
3. Introductory power transmission
4. Introductory fluid mechanics
5. Introductory mechanical measurement
6. Product reverse engineering
7. Design concept generation
8. Introductory mechanical fabrication
9. A design project

Computer usage:

1.This course is frequently taken concurrently or immediately after *MAE 141C Introduction to Engineering Design: CAD*, in which students learn to use computer aided design and solid modeling systems. They are encouraged (but not required) to use such software for project assignments.

Laboratory projects: Topics 1-6 listed above have a dedicated laboratory

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 0 credit

Engineering design: 2.0 credits

Prepared by: Mark Jakiela

Date: May 1, 2006

COURSE DESCRIPTION

JME 2410. Mechanics of Deformable Bodies Fall Semester 2005 & Spring Semester 2006

2005 Catalog Data : JME 2410. Mechanics of Deformable Bodies. Prerequisites: Math 1900 and Engineering 2310. Normal and shear stresses and strains. Stress-strain diagrams. Hooke's law and elastic energy. Thermal stresses. Stresses in beams, columns, torsional members, and pressure vessels. Elastic deflection of beams and shafts. Statically indeterminate structures. Mohr's circle of stress. Stability concepts. Credit 3 units.

Textbook: *Mechanics of Materials* by Beer & Johnston, McGraw Hill

References: None

Coordinator: Barna A. Szabo, Professor of Mechanical & Aerospace Engineering

Goals: Provide basic understanding of mechanics of materials, statically determinate structures, stability, an introduction to statically indeterminate structures and energy methods.

Prerequisites by topic:

1. Statics

Topics:

1. Stress-axial loads
2. Strain-Hooke's law
3. Torsion
4. Shear/bending diagrams
5. Pure bending
6. Shear
7. Compound stress
8. Plane stress
9. Pressure vessels/failure theories
10. Design
11. Deflection of beams
12. Indeterminate structures/force method
13. Euler formula

Computer usage:

None

Laboratory projects:

None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 3.0 credits

Engineering design: 0 credits

Prepared by: Barna A. Szabo **Date:** June 1, 2006

COURSE DESCRIPTION
JME 3200 Thermodynamics
Fall Semester 2005 & Spring Semester 2006

2005 Catalog Data : JME 3200 Thermodynamics. Prerequisites: Math 1900, Chemistry 1111 and Physics 2111. Classical thermodynamics, thermodynamic properties, work and heat, first and second laws. Entropy, irreversibility, availability. Application to engineering systems. Credit 3 units.

Textbook: General Thermodynamics: Foundation and Applications by Gyftopoulos and Beretta,

References: None

Coordinator: Eliot Fried, Associate Professor of Mechanical & Aerospace Engineering & Amy Shen, Assistant Professor of Mechanical & Aerospace Engineering

Goals: This course is designed to teach the fundamentals and basic applications of thermodynamics to mechanical and chemical engineering juniors.

Prerequisites by topic:

1. Calculus-differentiation and integration
2. General chemistry, including principles of chemical and ionic equilibria

Topics:

1. Basic concepts and definitions (thermodynamic systems, state, process; energy, work, equilibria)
2. General thermodynamic concepts (availability, entropy, temperature, chemical potentials)
3. Properties of pure simple compressible systems; ideal and real gases
4. Energy and energy analysis-The First Law of Thermodynamics
5. Entropy and entropy analysis-The Second Law of Thermodynamics
6. Availability and irreversibility

Computer usage:

None

Laboratory projects:

None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 3.0 credits

Engineering design: 0 credit

Prepared by: Eliot Fried/Amy Shen **Date:** June 1, 2006

COURSE DESCRIPTION
JME 3210. Energetics for Mechanical Engineers
Spring Semester 2006

2005 Catalog Data : JME 3210. Energetics for Mechanical Engineers. Prerequisite: JME 3200. Thermodynamic cycle analysis: vapor power, internal combustion, gas turbine, refrigeration. Maxwell relations and generalized property relationships for non ideal gases. Mixtures of ideal gases, psychrometrics, ideal solutions. Combustion processes, first and second law applications to reacting systems. Chemical equilibrium. Compressible flow in nozzles and diffusers. Credit 3 units.

Textbook: Thermodynamics by Wark, McGraw Hill

References: General Thermodynamics: Foundations and Applications by Gyftopoulos and Beretta,

Coordinator: Richard Axelbaum, Associate Professor of Mechanical & Aerospace Engineering

Goals: Teach students to model and analyze power cycles and thermodynamic systems using energy and entropy balances.

Prerequisites by topic:

1. Introductory course in thermodynamics
2. Calculus-differentiation and integration
3. General chemistry, concept of chemical potentials

Topics:

1. Review of basic thermodynamic principles (energy, entropy, availability, irreversibility)
2. Maxwell relations, nonideal gases, mixtures and solutions
3. Thermodynamic cycles; gas turbines; steam turbines; piston engines; refrigeration
4. Chemical reactions and combustion
5. Innovative power cycles and alternative energy sources

Computer usage:

None

Laboratory projects:

None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 3.0 credits

Engineering design: 0 credit

Prepared by: Richard Axelbaum **Date:** June 1, 2006

COURSE DESCRIPTION

JME 3221. Mechanical Design and Machine Elements

Spring Semester 2006

2005 Catalog Data : Prerequisites: JME 1414, JME 1415, JME 2410, JEMT 3170. Provides a thorough overview of the steps in the engineering design process and introduces analytical/quantitative techniques applicable to each step. Topics include recognition of need, specification formulation, concept generation, concept selection, embodiment and detail design. Includes an introduction to several classes of machine elements such as bearings, gears, belts, brakes, and springs. Underlying analytical model of the machine elements are presented along with guidelines about designing and choosing such elements for practical applications. A case study from industry will emphasize how the steps of the design process were done as well as the rationale for choosing particular machine elements. Credit 4 units.

Textbooks (Required): Norton, R. L., Machine Design – An Integrated Approach, 3rd. Ed., Prentice-Hall Inc., Upper Saddle River N. J., 2006, ISBN: 0-13-148190-8 (hard cover). Also <http://www.designofmachinery.com/MD/>

Textbooks (Recommended): Ulrich, K. T., Eppinger, S. D., Product Design and Development, 3rd. Ed., Irwin McGraw-Hill, Boston and New York, 2004, ISBN: 0-07-247146-8.
Also <http://www.ulrich-eppinger.net>

Textbooks (Reference): Otto, K. N., Wood, K. L., Product Design, Prentice-Hall Inc., Upper Saddle River N. J., 2001, ISBN: 0-13-021271-7. Also http://cwx.prenhall.com/bookbind/pubbooks/otto_wood/

Coordinator: Mark Jakiela, Hunter Professor of Mechanical Design.

Goals: First, to introduce a process for mechanical engineering design and product development. Students are required to attempt each step with relevant assignments. Second, to introduce methods for the design and choice of machine elements. Third, to provide experience integrating the first two goals with a significant realistic project.

Prerequisites by topic:

1. Statics
2. Dynamics
3. Materials science
4. Mechanics of deformable bodies

Topics:

10. The design process.
11. Design considerations for specific machine elements.
12. Creation/embodiment of a realistic mechanical device.

Computer usage: Prior to beginning this course, the students are likely to have background with a variety of practically useful software packages such as wordprocessors, spreadsheets, and computer aided design and geometric modeling systems. They are encouraged (but not required) to use these packages for textbook and project assignments.

Laboratory projects: None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 0 credit

Engineering design: 4.0 credits

Prepared by: Mark Jakiela

Date: May 1, 2006

COURSE DESCRIPTION
JME 3250. Materials Science for JME
Fall Semester 2005 & Spring Semester 2006

2005 Catalog Data : JME 3250. Materials Science for JME. Prerequisite: Chemistry 1111. Introduces the chemistry and physics of engineering materials. Emphasis on atomic and molecular interpretation of physical and chemical properties, the relationships between physical and chemical properties, and performance of an engineering material. Credit 4 units.

Textbook: Materials Science and Engineering: An Introduction (2nd Edition) William D. Callister, Jr. (John Wiley & Sons, Inc.)

References: None

Coordinator: Shankar M. L. Sastry, Professor of Mechanical & Aerospace Engineering

Goals: To gain thorough understanding of the structure of different materials on atomic, micro, and macro levels and develop interrelationships between advanced manufacturing/processing methods, microstructural evolution during various stages of material fabrication, and properties of materials.

Prerequisites by topic:

1. General chemistry
2. General physics
3. One year calculus

Topics:

1. The structure of crystalline solids, imperfections in solids, diffusion in crystalline materials
2. Dislocations and strengthening mechanisms, mechanical properties of metals
3. Fracture, fatigue, creep
4. Phase diagrams and phase transformations, alloys
5. Structures and properties of ceramics
6. Applications and processing of ceramics
7. Polymer structures
8. Characteristics, applications, and processing of polymers
9. Metal-, polymer-, and ceramic-matrix composites
10. Corrosion
11. Electrical, thermal, magnetic, and optical properties

Computer usage: None

Laboratory projects:

1. Microstructural analysis by optical microscopy
2. Tensile properties of metals
3. Heat treatment of steels
4. Strain hardening
5. Hardness testing
6. Impact testing

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 4.0 credits

Engineering design: 0 credit

Prepared by: Shankar M. L. Sastry **Date:** June 1, 2006

COURSE DESCRIPTION
JME 3360. Materials Science for JCE
Summer 2005

2005 Catalog Data : JME 3360. Materials Science for JCE. Prerequisite: Chemistry 1111. Same as JME 3250 but without the laboratory. Introduces the chemistry and physics of engineering materials. Emphasis on atomic and molecular interpretation of physical and chemical properties, the relationships between physical and chemical properties, and performance of an engineering material. Credit 4 units.

Textbook: Materials Science and Engineering: An Introduction (2nd Edition) William D. Callister, Jr. (John Wiley & Sons, Inc.)

References: None

Coordinator: Shankar M. L. Sastry, Professor of Mechanical & Aerospace Engineering

Goals: To gain thorough understanding of the structure of different materials on atomic, micro, and macro levels and develop interrelationships between advanced manufacturing/processing methods, microstructural evolution during various stages of material fabrication, and properties of materials.

Prerequisites by topic:

1. General chemistry
2. General physics
3. One year calculus

Topics:

1. The structure of crystalline solids, imperfections in solids, diffusion in crystalline materials
2. Dislocations and strengthening mechanisms, mechanical properties of metals
3. Fracture, fatigue, creep
4. Phase diagrams and phase transformations, alloys
5. Structures and properties of ceramics
6. Applications and processing of ceramics
7. Polymer structures
8. Characteristics, applications, and processing of polymers
9. Metal-, polymer-, and ceramic-matrix composites
10. Corrosion
11. Electrical, thermal, magnetic, and optical properties

Computer usage: None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 4.0 credits

Engineering design: 0 credit

Prepared by: Shankar M. L. Sastry **Date:** June 1, 2006

COURSE DESCRIPTION
JME 3611 Materials Engineering
Spring Semester 2006

2005 Catalog Data : JME 3611. Materials Engineering. Prerequisite: JME 3250. This course deals with the application of fundamental materials science principles in various engineering disciplines. Topics covered include design of new materials having unique property combinations, selection of materials for use in specific service environments, prediction of materials performance under service conditions, and development of processes to produce materials with improved properties. The structural as well as functional use of metals, polymers, ceramics, and composites will be discussed.. Credit 3 units

Textbook: Engineering Materials and Their Applications (Fourth Edition)
Richard A. Flinn and Paul K. Trojan (Publisher: Houghton Mifflin Co.)

References:

1. Principles of Materials Science and Engineering
William F. Smith, (Pub: McGraw-Hill, Inc.)
2. Introduction to Engineering Materials
G.T. Murray (Pub: Marcel Dekker)

Coordinator: Shankar M.L. Sastry, Professor of Mechanical & Aerospace Engineering

Goals: Develop of working knowledge of the application of materials science principles in the design of structural components, selection of materials for structural components, and prediction of performance of structural components in different types of service environments.

Prerequisites by topic:

1. Atomic Structure and Interatomic bonding
2. The structure of crystalline Solids
3. Imperfections in Solids
4. Diffusion
5. Dislocations and Strengthening Mechanics
6. Phase Diagrams and Phase Transformations in Metals
7. Structure and Properties of Ceramics
8. Ceramics Phase Diagrams
9. Polymer Structure

Topics:

1. Review of basic principles of materials engineering
2. Design-critical mechanical properties
3. Stress-strain relations in metals, polymers, and ceramics
4. Test methods for the measurement of mechanical properties
5. Fatigue and Fracture toughness of materials
6. Environmental effects on materials: Corrosion, Oxidation, & Hydron embrittlement
7. Engineering alloys for structural applications: Steels, cast irons, non-ferrous alloys
8. Composites
9. Thermals, electrical, optical and magnetic properties

Computer usage:

Laboratory projects: None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 3.0 credits

Engineering design: 0 credit

Prepared by: Shankar M. L. Sastry **Date:** June 1, 2006

COURSE DESCRIPTION
JME 3700. Fluid Mechanics
Fall Semester 2005

2005 Catalog Data: JME 3700. Fluid Mechanics. Prerequisites: JEMT 3170 and Engineering 2320. Fundamental concepts of fluids as continua. Viscosity. Flow field: velocity, vorticity, streamlines. Fluid statics: hydrostatic forces manometers. Conservation of mass and momentum. Incompressible inviscid flow. Dimensional analysis and similitude. Flow in pipes and ducts. Flow measurement. Boundary-layer concepts. Flow in open channels. Credit 3 units.

Textbook: Fluid Mechanics: Fundamentals and Applications by Y.A. Cengel and J.M. Cimbala, McGraw Hill, 2006

References: None

Coordinator: Ramesh K. Agarwal, William Palm Professor of Mechanical & Aerospace Engineering

Goals: This course is designed to introduce the basic concepts governing the behavior of fluids at rest and in motion. The goal is to introduce these concepts through derivations from first principles, and through standard closed-ended homework problems. The applications of these principles for solving fluid flow problems are included throughout the course.

Prerequisites by topic:

1. Kinematics and dynamics of particles
2. Kinematics and dynamics of rigid bodies
3. Engineering mathematics including vector calculus, differential equations, and rudimentary numerical methods

Topics:

1. Introduction and Basic Concepts
 - what is a fluid, and application areas of fluid mechanics
 - classification of fluid flows
 - fluid properties, dimensions, and units
2. Fluid Statics and Pressure
 - pressure and manometer
 - hydrostatic forces on submerged planar and curved surfaces
 - buoyancy and stability
 - fluids in rigid body motion
3. Fluid Kinematics
 - Lagrangian and Eulerian descriptions
 - velocity and acceleration, material derivative
 - streamlines, pathlines and streaklines
 - dilatation and vorticity
4. Basic Analysis of Flowing Fluids
 - system and control volume
 - Reynolds transport theorem
 - integral form of mass conservation equation and applications
 - integral form of energy equation
 - Bernoulli equation and applications
 - integral form of linear momentum equation and applications
 - integral form of angular momentum equation and applications
5. Dimensional Analysis and Similarity

- Buckingham Pi theorem
- methodology of finding dimensionless groups
- standard dimensionless groups
- similitude
- 6. Incompressible flow in ducts/pipes
 - laminar flow in a circular duct
 - friction factor, pressure drop and head loss
 - laminar flow in non-circular ducts
 - turbulent flow in pipes, Moody diagram
 - minor losses
 - pipe networks in series and parallel
 - flow rate and velocity measurement
- 7. Differential Analysis of Fluid Flow
 - derivation of continuity equation and linear momentum equation
 - simplification of continuity and Navier-Stokes equations
 - incompressible, inviscid and irrotational flow
 - stream function, potential function and Bernoulli equation
 - basic potential flows and their superposition to calculate flow past bodies
 - exact solutions of continuity and Navier-Stokes equations
- 8. External Viscous Flow Past bodies
 - boundary layer concepts and separation
 - laminar and turbulent boundary layer over a flat plate
 - momentum integral analysis of boundary layer flow
 - forces on bodies in viscous flow, lift and drag coefficients
- 9. Flow in Open Channels
 - introductory concepts, uniform and varied flow
 - laminar and turbulent flow in channels, hydraulic radius
 - Froude number and wave speed
 - continuity and energy equation, specific energy and critical flow
 - uniform flow, Chezy and Manning Formulas
 - analysis and design of uniform flow channels
 - rapidly varying flow and hydraulic jump

Computer usage:

1. Basic numerical methods in support of analysis
2. MATLAB

Laboratory projects:

None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 3.0 credits

Engineering design: 0 credit

Prepared by: Ramesh Agarwal/Da-ren Chen **Date:** June 1, 2006

COURSE DESCRIPTION
JME 3710. Principles of Heat Transfer
Spring Semester 2006

2005 Catalog Data : JME 3710. Principles of Heat Transfer. Prerequisites: JME 3200, JME 3700 and JEMT 3170. Introductory treatment of the principles of heat transfer by conduction, convection, or radiation. Mathematical analysis of steady and unsteady conduction along with numerical methods. Analytical and semiempirical methods of forced and natural convection systems. heat exchangers: LMTD and e-NTU analysis. Boiling and condensation heat transfer. Radiation between blackbody and real surfaces. Radiation network analysis. Credit 3 units.

Textbook: Introduction to Heat Transfer by Incropera & DeWitt, Wiley & Sons

References: Text required for MAE 370, SSM 317

Coordinator: Richard A. Gardner, Professor of Mechanical & Aerospace Engineering

Goals: The goal of this junior-level course is to develop systematic methods of analysis in order to determine the temperature distribution and heat transfer rates in engineering components and devices.

Prerequisites by topic:

1. Thermodynamics work, energy, heat transfer properties of pure substances first law of thermodynamics
2. Fluid mechanics
 - Reynolds transport theorem
 - Navier-Stokes equation
 - dimensional analysis and similitude
 - boundary layer concepts
 - turbulence concepts
3. Advanced calculus
 - ordinary, partial, total derivatives
 - second-order ODE's
 - eigenvalue problems

Topics:

1. Derivation of energy equation boundary and initial conditions
2. Conduction heat transfer
 - 1, 2, 3, dimension steady-state
 - transient conduction by lumped capacity or charts
 - analytical solutions numerical results
3. Convection heat transfer
 - forced convection inside ducts
 - external forced convection heat transfer
 - natural convection
4. Boiling and condensation
5. Heat exchangers
6. Radiation heat transfer
 - radiation laws
 - properties of real surfaces
 - configuration factors
 - radiation in enclosures (network method)

Computer usage:

Weekly homework assignments are generally completed with the use of hand calculators. The assignment under numerical methods in conduction heat transfer and the network analysis of radiation heat transfer involve matrix manipulation which students complete on either main frame computers or hand-held calculators.

Laboratory projects:

None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 3.0 credits

Engineering design: 0 credit

Prepared by: Richard A. Gardner **Date:** June 1, 2006

COURSE DESCRIPTION
JME 3721. Fluid Mechanics Laboratory
Spring Semester 2006

2005 Catalog Data : JME 3721. Fluid Mechanics Laboratory. Prerequisite: JME 3700. Physical laboratory exercises focusing on fluid properties and flow phenomena covered in JME 3700. Calibration and use of a variety of equipment; acquisition, processing, and analysis of data by manual as well as automated methods. Credit 1 unit.

Textbook: None

References: Text required for MAE 370

Coordinator: Raimo J. Hakkinen, Professor (Part-time) of Mechanical & Aerospace Engineering

Goals: This course is designed to give juniors in mechanical engineering physical contact with the principles and phenomena introduced in MAE 370 Fluid Mechanics and experience in basic measurements of fluid properties and flow parameters.

Prerequisites by topic:

1. Thermodynamics and transport properties of liquids and gases
2. Ideal gas law
3. Bernoulli equation, basic and extended forms
4. Similitude
5. Frictional losses in piping systems
6. Open channel flow
7. Boundary-layer concepts
8. Pressure and friction forces on bodies immersed in flow

Topics:

See laboratory projects below

Computer usage:

The wind-tunnel exercises employ a dedicated computer (PC) and printer to acquire force and pressure data, and to process these data into curves of drag coefficient vs. Reynolds number and boundary-layer velocity profiles.

Laboratory projects:

1. Measurements of liquid density, surface tension and viscosity
2. Performance characteristics of centrifugal pumps
3. Open channel flow; weirs; inclined surface; hydraulic jump
4. Pipe flow; velocity profile; major and minor losses
5. Aerodynamic drag on a sphere, and boundary-layer velocity profiles on a flat plate, conducted in a low speed, wind tunnel

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 1.0 credits

Engineering design: 0 credit

Prepared by: Raimo J. Hakkinen **Date:** June 1, 2006

COURSE DESCRIPTION

JME 3722. Heat-Transfer Laboratory Fall Semester 2005 & Spring Semester 2006

2005 Catalog Data : JME 3722. Heat-Transfer Laboratory. Prerequisites: JME 3721 and JME 3710. Physical laboratory exercises, including some numerical simulations and computational exercises, focusing on heat-transfer phenomena covered in JME 3710. Calibration and use of variety of laboratory instrumentation; acquisition, processing, and analysis of data by manual as well as automated methods; training in formal report writing.. Credit 1 unit.

Textbook: None

References: Text required for MAE 371

Coordinator: Richard A. Gardner, Professor of Mechanical & Aerospace Engineering

Goals: This course is designed to give juniors in mechanical engineering physical contact with the principles and phenomena introduced in MAE 371, Heat Transfer, and experience in basic measurements of temperature, heat flow, turbulence and radiative energy flux.

Prerequisites by topic:

1. Principles of heat conduction in isotropic and anisotropic solids
2. Thermodynamics and transport properties of liquids and gases
3. Boundary-layer concepts
4. Free and forced convection
5. Radiation through non-absorbing media
6. Solar radiation

Topics:

1. 1-D, 2-D steady and un-steady conduction experiments
2. Convection: natural and forced convection from a heated cylinder
3. Radiation: view factor determination, emissivity and temperature measurements

Computer usage:

At least one project will be computational. For example, students will be required to write a program to compute the steady-state temperature distribution in a two-dimensional fin with specified boundary conditions.

Laboratory projects:

1. Computation of temperature distribution in a two-dimensional fin, one-dimensional slab and radiation circular hole
2. Rate of heat conduction through a heat pipe; effective conductivity
3. Free and forced convection from a constant temperature hot-film anemometer
4. Optical determination of view factors between a point source of radiation and various plane bodies
5. Heat transfer in a shell-and-tube heat exchanger
6. Heat transfer measurements with a vortex tube generators

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 1.0 credits

Engineering design: 0 credit

Prepared by: Richard A. Gardner **Date:** June 1, 2006

COURSE DESCRIPTION

JME 3750. Fluid Control & Power Systems: Theory & Practice Spring Semester 2006

2005 Catalog Data : JME 3750. **Fluid Control & Power Systems: Theory & Practice:** Design of hydraulic and pneumatic control and power systems using advanced concepts and analytical tools. Analysis of fluid flow through small orifices and between parallel and inclined planes. Theory of spool and flapper valves. Overview and definitions: feasibility, synthesis, analysis and applications of fluid systems. Physical configuration of practical components: pumps, motors (rotary and linear, fixed and variable delivery), fluid lines and valves, accumulators and storage devices, etc. Integration of components into practical systems: ordinary power systems, servo-systems, hydrostatic transmissions, etc. Development of realistic performance diagrams using MATLAB Symulink. Application of performance diagrams in design and analysis of fluid power systems. Note: Symulink will be introduced at the beginning of the semester.. Credit 3 units.

Coordinator: Mario Gomez, Adjunct Professor of Mechanical Engineering

Computer usage: Symulink will be introduced at the beginning of the semester

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 1.0 credits

Engineering design: 0 credit

Prepared by: Mario Gomez **Date:** June 1, 2006

COURSE DESCRIPTION
JME 4040. Senior Design Project
Fall Semester 2005

2005 Catalog Data : JME 4040P. Senior Design Project. Prerequisite: JME 2410, JME 3200, JME 3221, JME 4250, JME 3700, and JME 3710 Corequisites: JME 4170, JME 4180. Working individually, students initially perform a feasibility study for a mechanical design project. Projects consisted of an open-ended, original design or a creative redesign of a mechanical component or system requiring the application of those engineering science principles inherent to mechanical engineering. Feasibility is considered subject to economic, safety, legal, environmental, ethical, aesthetic, and other constraints in a competitive manufacturing environment. Feasible projects are then selected by teams of three to five students who perform the detailed design and optimization of the design concept developed in the feasibility study. The designs are carried out to detailed shop drawings and where possible a mockup or prototype is built. Periodic oral presentations and written reports give students practice in engineering and business communication. Guidance and consultation for the design projects are provided by the course and department faculty. Credit 5 units.

Textbook: None

References: Engineering Design, Pahl & Beitz
Ethics in Engineering Practice and Research, Whitbeck
Course website with links: <http://mesun4.wustl.edu/ME/MEhome.html>

Coordinator: Ruth Okamoto, Assistant Professor of Mechanical & Aerospace Engineering

Goals: Working in teams of two to three students, perform the detailed design and optimization of a mechanical device or system deemed feasible in MAE404A and using the design concept developed in that course. Additional projects may be provided by faculty. The design is carried out to detailed shop drawings and where possible a mockup or prototype is built by performing detail design the students apply engineering science principles learned in previous courses. Midterm and final oral presentations and written reports give the students practice in communication within the engineering business environment. Weekly lectures, case studies, and discussion are used to introduce and stress the importance of engineering teamwork, ethics, and professional standards.

Prerequisites by topic:

Mechanical Engineering Design I (conceptual design and feasibility studies)
Computer Aided Design
Corequisites by topic:
Machine Design
Vibrations
Heat Transfer
Fluid Mechanics

Topics:

1. Project Management
2. Product Liability: Engineering and Legal Aspects
3. Engineering Ethics
 - Organizational Responsibility
 - Engineering Registration
 - Personal Responsibility

4. Environmentally Responsible Design
5. Design of Biomedical Devices

Computer usage:

CAD software: AutoCAD or SolidEdge
Internet resources accessed via course website

Laboratory projects:

1. None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 0 credit

Engineering design: 5.0 credits

Prepared by: Ruth Okamoto **Date:** June 1, 2006

COURSE DESCRIPTION
JME 4041. Engineering Design Topics
Spring Semester 2006

2005 Catalog Data : **JME 4041. Engineering Design Topics.** Prerequisites: Senior Standing. Case studies of engineering failures, class discussion and short written papers are used to illustrate and stress the importance of engineering teamwork, ethics, and professional standards within the mechanical engineering discipline. Working in teams, students develop and present a case study on a topic of their choice. Guest lecturers introduce contemporary topics such as product liability, environmental regulations, green design, appropriate technologies, and concurrent engineering. Credit 1 unit.

Textbook: None

References: Web Sites

American Society of Mechanical Engineers – ASME
National Society of Professional Engineers - NSPE
Engineering Ethics at Texas A&M
The Online Ethics Center for Engineering & Science
 Case Study: The Challenger Disaster
 Drug Testing on a Plant Trip
 Subtle Discrimination Scenario
 Testing by a CO-OP Student
Missouri Board for Architects, Professional Engineers and Land Surveyors
 Code of Professional Conduct
ASME Code of Ethics
US Consumer Product Safety Commission
United States Department of Justice
Missouri State Government
Federal Web Locator
US Government, State Government, Congress, etc. Information
Laws of the City of St. Louis Government
Library of Congress
Center for Disease Control and Prevention
Fastener Quality Act (FQA)

Coordinator: Ruth Okamoto, Professor of Mechanical Engineering

Format:: This class is structured around group discussions on both current and historical events concerning mechanical engineers and their careers. Students are expected to be prepared for the discussion topics and to contribute to the discussions.

Homework: Homework assignments will consist primarily of gathering materials relevant to the next class discussion. A hard copy of the homework materials will be turned in at the beginning of each class.

Teamwork: Some of the homework will be done by teams who will be assigned to argue the next week's topic from opposing points of view.

ABET category content as estimated by faculty member who prepared this course description:

This course contributes to the following four educational objectives of the Washington University Mechanical Engineering Program.

6. "Be exposed to modern developments, products and tools as they relate to engineering practice"... *Students research and discuss engineering ethics case studies based on both recent and historical engineering failures. Case studies include the ethical, and legal responsibility of individuals, corporations and governments.*
7. "Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards"... *Case studies and lectures are structured to review and reinforce the "Codes of Ethics" and "Fundamental Canons" published by the American Society of Mechanical engineers, the National Society of Professional Engineers and the National Council of Engineering Examiners. Students learn the purpose and importance of professional registration.*
8. "Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts"... *Case studies and lectures include a wide range of engineering disciplines and address cultural differences and diversity in the business world.*
9. "Recognize the need for (and obtain the tools necessary to engage in) life-long learning"... *In conjunction with cases on workplace ethics students research and discuss career paths for mechanical engineers and the need for sustainable development of their skills.*

Engineering science: 0 credit

Engineering design: 1.0 credits

Prepared by: Thomas L. Bever, P.E.

Date: February 13, 2006

COURSE DESCRIPTION

JME 4170. Dynamic Response of Physical Systems – Lectures

JME 4180. Dynamic Response of Physical Systems – Laboratory Sessions

Summer Semester 2005

2005 Catalog Data: **JME 4170 and JME 4180 . Dynamic Response of Physical Systems.** Free and forced vibration of mechanical systems with lumped inertia, springs, and dampers. Methods of Laplace transform, complex harmonic balance, and Fourier series. Electrical analogs. Introduction to Lagrange's equations of motion and matrix formulations. Transient response of continuous systems by partial differential equations, by Rayleigh method, and by lumped parameters. Laboratory experiments. Prerequisites: ME 232, SSM 317. Credit 4 units.

Textbook: Mechanical Vibrations by Singiresu S. Rao, Addison/Wesley

References: Theory of Vibration with Applications by William Thompson. Prentice-Hall

Coordinator: Dale M. Pitt, Professor of Mechanical Engineering

Goals: This course examines the free and forced dynamic response of linear mechanical systems. The goal is to provide mechanical engineering seniors with the analytical and experimental tools necessary to design and analyze dynamic mechanical systems. These systems may or may not possess viscous damping. The students are also initiated into the field of computational dynamics with the implementation of specific homework problems that require the use of MATLAB®.

Prerequisites by topic:

1. Particle kinetics and Newton's Laws
2. Kinetics of rigid bodies
3. Solution of ordinary differential equations
4. Laplace transforms for systems of ordinary differential equations
5. Matrix methods, eigenvalues and eigenvectors
6. Fourier series
7. Computer programming (MATLAB®)
9. Laboratory procedure and standard instrument usage

Topics:

1. Discrete elements and discretization using energy methods
2. Single degree of freedom systems
3. Linearization
 - Free Vibration
 - Harmonic excitation
 - Periodic excitation
 - General excitation
 - Convolution integral
 - Numerical methods for linear systems
4. "N" degree of freedom systems
 - Two degree of freedom systems
 - Generalized coordinates and forces
 - Lagrange's equations
 - Modal analysis: Natural frequencies and mode shapes.

Computer usage:

The JME 4180 class has laboratory sessions that will involve the use of computers to acquire and manipulate data. Two Macintosh micro-computers with A-D conversion hardware and signal processing software are available for use in several experiments. The CEC computers are also used on a routine basis to determine eigenvalues and eigenvectors associated with laboratory experiments and homework problems. The students use MATLAB® on the CEC computers or their own personal computers.

Laboratory projects:

1. Fourier transformation of oscillatory waveforms
2. Experimental comparison of energy-derived discrete models to continuous systems
3. Response to a rotating unbalance
4. Design of a vibration-isolation system
5. Response of a multi-degree of freedom system, experimental determination of the natural frequencies and the mode shapes
6. Investigation of automotive suspension design
7. Rayleigh's quotient and the dynamic response of a cantilever beam

ABET category content as estimated by faculty member who prepared this course description:**Engineering science:** 2.0 credits**Engineering design:** 2.0 credits

Prepared by: Dale M. Pitt **Date:** May 30, 2006

COURSE DESCRIPTION
JME 4250 Materials in Engineering Design
Summer Session 2005

2006 Catalogue Data: **JME 4250 Materials in Engineering Design** Prerequisite: Senior standing. Analysis of the scientific bases of material behavior in the light of research contributions of the last 20 years. Development of a rational approach to the selection of materials to meet a wide range of design requirements for conventional and advanced applications. Although emphasis will be placed on mechanical properties, other properties of interest in design will be discussed, e.g., acoustical, optical and thermal. Credit 3 units.

Textbook: *Materials and Engineering Design: The Next Decade*, Edited by B.F. Dawson and D. R. Hayhurst, the Institute of Metal, 1989.

References: *Materials Handbook*, Volume 20, 10th Edition, ASM International, Materials Park, OH.

Coordinator: Mario Gomez, Adjunct Professor of Mechanical & Aerospace Engineering

Goals: Emphasis will be placed on mechanical properties of materials. Other properties of interest in design will also be discussed.

Prerequisites by topic:

Graduate Standing

Topics:

1. Crystalline structure.
2. Heat treatment.
3. Buckling and fracture mechanics.
4. Manufacturing.
5. Metallurgy of steel
6. Aluminum alloys.
7. Applications.

Computer Usage: None.

Laboratory Projects: None.

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 1.0 credits

Engineering design: 2.0 credits

Prepared by: Mario Gomez

Date: August 10, 2006

COURSE DESCRIPTION
JME 4310 Control Systems I
Fall 2005

2005 Catalogue Data: **JME 4310 Control Systems I.** Prerequisite: JEMT 3170, JEE 2300 (same as JEE 4410). Introduction to automatic control concepts. Block diagram representation of single- and multi-loop systems. Multi-input and multi-output systems. Control system components. Transient and steady-state performance; stability analysis; Routh, Nyquist, Bode, and root locus diagrams. Compensation using lead, lag, and lead-lag networks. Synthesis by Bode plots and root-locus diagrams. Introduction to state-variable techniques, state transition matrix, state-variable feedback. Credit 3 units.

Textbook: **Dorf, Richard C.** *Modern Control Systems*, Addison-Wesley 10th Edition

Coordinator: Karl Spuhl, Adjunct Professor of Mechanical Engineering

Goals:

1. Modeling physical systems mathematically
2. Developing tools and skills to analyze these models to determine if the system performs within specification and to determine necessary design strategies to meet specification.

Prerequisites by topic:

- Good working knowledge of Algebra
- Calculus
- Fundamentals of the physics of mechanics systems
- Fundamentals of DC and AC Circuits including operational amplifiers
- Matrix Algebra
- Laplace Transforms

Topics:

- Block diagram representation of single- and multi-loop systems.
- Multi-input and multi-output systems.
- Control system components.
- Transient and steady-state performance; stability analysis; Routh, Nyquist, Bode, and root locus diagrams.
- Compensation using lead, lag, and lead-lag networks.
- Synthesis by Bode plots and root-locus diagrams.
- Introduction to state-variable techniques, state-transition matrix, state-variable feedback.

Computer Usage: Computer aided design tools are used for homework and design projects. MatLab, a commercial software package, provides a computer aided engineering system or designer's workbench. Students use MatLab for matrix analysis, control system design, system analysis and the preparation of graphics for project reports..

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 2.0 credits

Engineering design: 1.0 credits

Prepared by: Karl Spuhl

Date: Dec. 5, 20056

COURSE DESCRIPTION
JME 4490 Sustainable Air Quality
Spring Semester 2006

2005 Catalog Data : **JME 4490. Sustainable Air Quality.** Course serves as an introduction to sustainability and sustainable air quality issues. Systems science is used as an organizing principle for air quality management: setting of air quality goals, observing the status and trends and establishing causal factors. After understanding the causal effect forecasts can be made to determine types of corrective actions to reach air quality goals through process design for emission reductions and adoptive response to air pollution episodes. A web-based class project integrating all of these topics will be conducted through the semester. Credit: 3 units.

Textbook: None

References:

NAS Sustainability Report, Our Common Journey: A Transition Toward Sustainability (1999)

An analysis of the relationship between sustainable development and the anthroposystem concept, Miguel A. Santos, Walter Leal Filho Int. J. Environment and Sustainable Development, Vol. 4, No. 1, 2005

ECOSYSTEM AND THE BIOSPHERE: Metaphors for Human-Induced Material Flows, Rudolf B. Husar, Chapter in "Industrial Metabolism: Restructuring for Sustainable Development", by Robert U. Ayres and Udo E. Simonis, (eds.), United Nations University Press, 1994.

SULFUR AND NITROGEN EMISSION TRENDS FOR THE U.S.
Rudolph Husar, Chapter for "Industrial Metabolism: Restructuring for Sustainable Development", by Robert U. Ayres and Udo E. Simonis, (eds.), United Nations University Press, 1994.

Coordinator: R. B. Husar, Professor of Mechanical & Aerospace Engineering

Goals:

1. Collaborate on group projects with each person contributing something to better the group
2. Learn how to analyze and synthesize data coming from multiple sources
3. Forecast sulfur emissions based on historical trends
4. Manipulate forecast in order to show how changes to a particular fuel type or sector would impact future pollution output

Prerequisites by topic: Junior standing

Topics: What is sustainability?
Anthroposystems
Sulfur emission trend analysis and forecast

Computer usage: Excel, Powerpoint, other Microsoft Office tools
Class Wiki website development(<http://capitawiki.wustl.edu/ME449/>). Wiki is a collaborative user-editable website that class projects were planned and carried out on.

Laboratory projects:

1. Anthroposystem article posted to Wikipedia (<http://en.wikipedia.org/wiki/Anthroposystem>)
2. Sulfur Emission Inventory Update, Forecast
(http://capitawiki.wustl.edu/ME449/index.php/Sulfur_Emissions_Project)

ABET category content as estimated by faculty member who prepared this course description:

Engineering Science: 3.0 credits

Engineering design: 0 credit

Prepared by: R.H. Husar

Date: July 1, 2006

COURSE DESCRIPTION
JME 4530 Facilities Design
Fall 2005

2005 Catalogue Data: **JME 4530 Facilities Design.** Prerequisite: Senior standing. The goal of the course is to provide the student with the information and analytical tools necessary to take a product design into production and for the design of an efficient manufacturing facility that will make the production feasible. Quantitative methods in the design of manufacturing facilities. Space allocation, assembly line design, material-handling systems, utilities and environmental design for manufacturing facilities. Facility-location selection. Plant-layout development. Building, organization, communications and support system design. Material-handling equipment, flow and packaging. Automated storage and retrieval systems design. Computer aided design of manufacturing facilities. Environmental requirements and design. Utilities design. In a major project, students will be required to analyze the design of a product and plan the manufacturing facility for its production. Credit 3 units.

Textbook: **“Plant Layout and Materials Handling,” by Apple**

Coordinator: Allan Holtzman, Adjunct Professor of Mechanical Engineering

Goals:

1. To learn a scientific approach to solving plant layout problems
2. To design a complete plant layout working as a team.

Topics:

- Facilities Design Function
- Designing the process and material flow.
- Quantitative techniques for analyzing material flow.
- Planning activity relationships
- Physical plant design
- New layout techniques
- Introduction to materials handling
- Materials handling equipment
- Constructing the layout
- Building construction and location.

Computer Usage: Computerized layout techniques, computer aided design of manufacturing facilities.

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 2.0 credits

Engineering design: 1.0 credits

Prepared by: Al Holtzman

Date: May. 5, 2006

COURSE DESCRIPTION

JME 4810. Air-Conditioning Systems and Equipment I Fall Semester 2005 & Spring Semester 2006

2005 Catalog Data : JME 4810. Air-Conditioning Systems and Equipment I. Prerequisite: Senior standing. Survey of air conditioning systems. Moist air properties and conditioning processes. Adiabatic saturation. Psychrometric chart. Environmental indices. Indoor air quality. Heat balances in building structures. Solar radiation. Space heating and cooling loads. Credit 3 units.

Textbook: Heating, Ventilating, & Air Conditioning Analysis & Design by McQuistan & Parker, Wiley

References: ASHRAE Handbook of Fundamentals

Coordinator: Harold J. Brandon, Affiliate Professor of Mechanical Engineering

Goals: These courses are structured to give senior and first year graduate students in mechanical engineering the capability to analyze and design heating, ventilating, and air conditioning systems.

Prerequisites by topic:

1. All topics require a knowledge of thermodynamic, heat transfer, and fluid mechanics

Topics:

1. Moist air properties and conditioning processes
2. Heat transmission in building structures
3. Solar radiation
4. Space heat load analysis
5. Cooling load analysis
6. Fluid flow, pumps, and piping design
7. Fans and building air duct design
8. Complete air-conditioning systems
9. Room air distribution
10. Mass transfer and the measurement of humidity
11. Direct contact transfer processes.
12. Extended surface heat exchangers
13. Refrigeration

Computer usage:

The mechanical engineering department has a software license agreement with the TRANE Company in LaCrosse, Wisconsin to use four HVAC design computer programs:

1. Building load design code
2. Duct design code using the equal friction method
3. Duct design code using the static regain method
4. Water Piping Code.

Eight homework assignments require the use of all four of these computer programs. These courses also require a final project which often involves computer analysis.

Laboratory projects:

None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 2.5 credits

Engineering design: .5 credits

Prepared by: Harold J. Brandon

Date: June 1, 2006

COURSE DESCRIPTION

JME 4820. Air-Conditioning Systems and Equipment II Fall Semester 2005 & Spring Semester 2006

2005 Catalog Data : JME 4820. Air-Conditioning Systems and Equipment II. Prerequisite: Senior standing. Fluid flow, pumps, and piping design. Room air distribution. Fans and building air distribution. Mass transfer and measurement of humidity. Direct control of heat and mass transfer. Heat exchangers. Refrigeration systems. Absorption refrigeration. Credit 3 units.

Textbook: Heating, Ventilating, & Air Conditioning Analysis & Design by McQuistan & Parker, Wiley

References: ASHRAE Handbook of Fundamentals

Coordinator: Harold J. Brandon, Affiliate Professor of Mechanical Engineering

Goals: These courses are structured to give senior and first year graduate students in mechanical engineering the capability to analyze and design heating, ventilating, and air conditioning systems.

Prerequisites by topic:

1. All topics require a knowledge of thermodynamic, heat transfer, and fluid mechanics

Topics:

1. Moist air properties and conditioning processes
2. Heat transmission in building structures
3. Solar radiation
4. Space heat load analysis
5. Cooling load analysis
6. Fluid flow, pumps, and piping design
7. Fans and building air duct design
8. Complete air-conditioning systems
9. Room air distribution
10. Mass transfer and the measurement of humidity
11. Direct contact transfer processes.
12. Extended surface heat exchangers
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Computer usage:

The mechanical engineering department has a software license agreement with the TRANE Company in LaCrosse, Wisconsin to use four HVAC design computer programs:

1. Building load design code
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3. Duct design code using the static regain method
4. Water Piping Code.

Eight homework assignments require the use of all four of these computer programs. These courses also require a final project which often involves computer analysis.

Laboratory projects:

None

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 2.5 credits

Engineering design: .5 credits

Prepared by: Harold J. Brandon

Date: June 1, 2006

Appendix I –C
Additional Program Information
Faculty Resumes

CURRICULUM VITAE

Name: Ricardo L. Actis

Date of birth: 3 June 1952

Academic rank: Adjunct Professor

Degrees:

B.S. 1975, Aeronautical Engineering, University of La Plata, Argentina.

M.S. 1985, Mechanical Engineering, Washington University.

DSc. 1991, Mechanical Engineering, Washington University.

Service on this faculty: 12 years

Original appointment: January 1994

Other related experiences:

Academic:

1975-1983: Teaching assistant in the Aeronautical Engineering Department, University of La Plata, Argentina. Responsible for homework assignment, grading and lecturing in courses in strength of materials, structural analysis, theory of elasticity and material sciences.

1985-1987: Assistant Professor of Aeronautical Engineering, University of La Plata, Argentina. Responsible for teaching two undergraduate courses in airplane structural analysis and design and one graduate course in fracture mechanics.

1988-1991: Teaching Research Assistant, School of Engineering, Washington University, St. Louis, Missouri. Grading and occasional lecturer in courses of finite element analysis and manufacturing engineering.

1994-Present: Adjunct Professor, department of Mechanical Engineering, Washington University. Responsible of teaching the course 'Mechanics of Deformable Bodies' for the joint UMSL/WU engineering program.

Industrial:

1974-1975: Structural Designer for Luisoni and Associates, a civil engineering firm in La Plata, Argentina.

1976-1983: Staff Engineer and later Division Manager for the Department of Mechanical Engineering, National Institute of Industrial Technology (INTI), Buenos Aires, Argentina. Activities included failure analysis, fatigue testing and structural and stress analyses.

1985: Diagnostic Engineer for Failure Analysis and Consulting Technical Services, Inc., St. Louis, Missouri

1990-1991: Structural and Stress Analysis Engineer for Weld-Met International, Inc., St. Louis, Missouri.

1991-present: Director of Engineering Development for Engineering Software Research and Development, Inc., St. Louis, Missouri. Responsible for managing the development of software related to the engineering functionalities of *StressCheck*, a p-version finite element analysis program. Responsible for the implementation of advanced FEA procedures, including material and geometric nonlinearities, thin solids formulation, plates and shells, composite material analysis, post-processing procedures, etc.

Principal publications, 2001-2006:

Z. Yosibash, **R. L. Actis**, and B. A. Szabó, "Extracting Edge Flux Intensity Functions for the Laplacian", *Int. J. Num. Meth. Engrg.*, Vol. 53, Issue 1, pp. 225-242 (2002).

R. L. Actis and B. A. Szabó, 'Analysis of Bonded and Fastened Repairs by the p-Version of the Finite Element Method', *Computers and Mathematics with Applications*, Vol. 46, pp. 1-14 (2003).

S. P. Engelstad and **R. L. Actis**, 'Development of p-version Handbook Solutions for Analysis of Composite Bonded Joints', *Computers and Mathematics with Applications*, Vol. 46, pp. 81-94 (2003).

B. A. Szabó and **R. L. Actis**, 'On the Importance and Uses of Feedback information in FEA', *Applied Numerical Mathematics*, Vol. 52, pp. 219-234 (2005).

Awards:

Awarded grant by U. S. Department of Defense (Small Business Technology Transfer Program - STTR) for the Phase I project: "Software for the Design and Certification of Unitized Airframe Components" Contract # FA9550-05-C-0128 (08/01/ 2005 - 01/31/2006).

Awarded follow-up contracts by the Boeing Company as part of Phase III of the STTR project: "Stress/Failure Analysis Software for Multi-Material Interfaces." CAI Program Data, Contracts JY9379 (8/26/99 - 7/7/00) and Z00803 (11/3/00 - 3/23/01). The main goal of these projects is to improve the analysis capabilities of *StressCheck* for the nonlinear analysis of laminated composite bonded joints.

Awarded grant by U. S. Department of Defense (Small Business Technology Transfer Program) for the Phase I and II project: "Stress/Failure Analysis Software for Multi-Material Interfaces." Phase I: Contract # F49620-95-C-0070, Project No. FQ8671-9501469 STTR/TS (9/15/ 1995 - 9/14/1996). Phase II: Contract # F49620-97-C-0045, Project No. FQ8671-9701107 STTR/TS (8/1/1997 - 7/31/1999). The main goal of this project was to develop a computer program with advanced capabilities for providing means for establishing reliable quantitative failure initiation criteria for laminated composites and adhesively bonded joints.

Awarded grant by National Science Foundation (Small Business Innovation Research) for the Phase I and II project: "Design and Analysis of Composite Multilayered Shells." Phase I: Grant No. III-9261593(1/1/1993 - 9/30/1993). Phase II: NSF award No. DMI-9321005 (10/1/1995 - 9/30/1997). The principal objective of this investigation was to provide a reliable and efficient prototype software for the engineering design and analysis of multilayered composite shells, capable of modeling linear and nonlinear behavior in three dimensions.

Professional registration: None**Courses taught during most recent academic year 2005-2006:****Fall semester:**

MAE-489 "Aerospace Structures"

Spring semester:

MAE 241/JMAE 141 "Mechanics of Deformable Bodies," 3 hours/week lecture.

Other assigned duties: None

CURRICULUM VITAE

Name: Ramesh K. Agarwal

Date of birth: 4 January 1947

Academic rank: Professor, full time

Degrees:

B.S., Indian Institute of Technology, Kharagpur, India, 1968

M.S., Aeronautical Engineering, University of Minnesota, 1969

Ph.D., Aeronautics and Astronautics, Stanford University, 1975

Service on this faculty: 5 years

Original appointment: September 2001, William Palm Professor of Engineering

Promotions: Director, Aerospace Engineering Program, 2003

Other related experiences:

Academic:

Director, Aerospace Research and Education Center (WUSTL), 2002-present

Executive Director, National Institute for Aviation Research, Wichita State University (WSU), 1996-2001

Sam Bloomfield Distinguished Professor and Chair, Aerospace Engineering, WSU, 1994-1996

Industrial:

Program Director and MDC Fellow, McDonnell Douglas Aerospace, 1978-1994

NRC Research Associate, NASA-Ames Research Center, 1976-1978

Principal Research Engineer, Rao and Associates, Inc., 1975-1976

Consulting:

Whirlpool Corporation, Benton Harbor, MI (2003)

Hussman Corporation, St. Louis, MO (2003)

Theracomp Corporation, Stonybrook, N.Y. (2004)

Missouri Enterprise, Rolla, MO (2004)

Professional registration:

None

Principal publications, 1992-2005

1. R.K. Agarwal, "Lattice Boltzmann Simulation of Slip Flow in Microchannels at High Knudsen Numbers" *Bulletin of American Physical Society*, 58th Annual Meeting of the Division of Fluid Dynamics, Chicago, IL, 20-22 November 2005.
2. R.K. Agarwal, "Lattice Boltzmann Simulation of Magnetohydrodynamic Slip Flow in Microchannels," *AIAA Paper 2005-0163*, 2005.
3. R.K. Agarwal and K.-Y. Yun, "Burnett Simulations of Flows in Micro-devices," *MEMS Engineering Handbook*, M. Gad-El-Hak, Editor, CRC Press, 2005, pp. 7-1 to 7-37.
4. R. K. Agarwal, "Hybrid Finite-Difference/Lattice-Boltzmann Simulations of Magnetohydrodynamic Flows," *Proc. Int. Conf. on Computational Fluid Dynamics (ICCFD1)*, Kyoto, Japan, June 2000; published by Springer-Verlag, N. Satofuka Editor, pp. 511-516, 2001.
5. R.K. Agarwal, K.-Y. Yun and R. Balakrishnan, "Beyond Navier-Stokes: Burnett Equations for Simulation of Transitional Flows," *Physics of Fluids*, Vol. 13, 2001, pp. 3061-3085.
6. R. K. Agarwal, R. Balakrishnan and K.-Y. Yun, "Beyond Navier-Stokes: Burnett Equations for Simulation of Hypersonic Flows in Continuum-Transition Regime," *Annual Review of Computational Physics*, Vol. 9, 2001, pp. 211-252.
7. R. K. Agarwal, "Computational Fluid Dynamics of Whole-Body Aircraft," *Annual Review of Fluid Mechanics*, Vol. 31, 1999, pp. 125-169.
8. R. K. Agarwal and D.W. Halt, "A Compact High-Order Unstructured Grids Method for the Solution of Euler Equations," *International Journal of Numerical Methods in Fluids*, Vol. 31, 1999, pp.121-147.

9. D. L. Marcum and R. K. Agarwal, "Finite Element Navier-Stokes Solver for Unstructured Grids," *AIAA Journal*, Vol. 30, No. 3, 1992, p. 648.
10. R. K. Agarwal and J. C. Lewis, "Computational Fluid Dynamics on Parallel Processors," *Computing Systems in Engineering*, Vol. 3, 1992, pp. 251-259.

Scientific and professional society membership:

Fellow, American Association for Advancement of Science (AAAS)

Fellow, American Physical Society (APS)

Fellow, American Institute of Aeronautics and Astronautics (AIAA)

Fellow, American Society of Mechanical Engineers (ASME)

Fellow, Society of Manufacturing Engineers (SME)

Fellow, Royal Aeronautical Society

Fellow, Society of Automotive Engineers (SAE)

Fellow, Institute of Electrical and Electronics Engineers (IEEE)

Fellow, World Innovation Foundation (WIF)

Member, American Helicopter Society

Member, American Society for Engineering Education

Member, Sigma Gamma Tau, Pi Tau Sigma, Tau Beta Pi

Honors and awards:

AIAA Distinguished Lecturer (1994-1999), ASME Distinguished Lecturer (1994-1997), IEEE Distinguished Lecturer (1994-present) Kansas Academy of Science Distinguished Lecturer (1996), American Physical Society Forum on Industrial and Applied Physics Distinguished Speaker (1995-present)

AIAA Sustained Technical Achievement Award (2002)

ASME Fluids Engineering Award (2001)

Missouri Academy of Science "Most Distinguished Scientist" Award (2003)

AIAA Civic Award – St. Louis Section (2003)

WSU President's Award for Distinguished Service (1998)

AIAA Engineer of the Year Award (1998)

University of Kansas Irving Youngberg Research Award in Applied Sciences (1998)

WSU Excellence in Research Award (1998)

WSU College of Engineering Award for Continuing Education (1996)

AIAA Technical Achievement Award—St. Louis Section (1991)

IEEE Award of Honor—St. Louis Section (1994)

I.I.T. Kharagpur Distinguished Alumni Award (1994)

Courses taught during most recent academic year 2005-2006:

Fall semester:

MAE 163 "Introduction to Nanotechnology," 2 hrs/wk lecture, day, undergraduate

MAE 370 "Fluid Dynamics," 3hrs/wk lecture, day, undergraduate

Spring semester:

MAE 380 "Aerodynamics," 3 hrs/wk lecture, day, undergraduate

Other assigned duties: Director, Aerospace Engineering Program (4 hours/week)

Director, Aerospace Research and Education Center (2 hours/week)

Participation in specific professional development programs: None

Other duties: None

CURRICULUM VITAE

Name: Xavier J. Avula

Date of birth: 8 January 1936

Academic rank: Research Professor

Degrees:

B.S., Indian Institute of Technology, Kharagpur, India, 1960

M.S., Mechanics, Michigan State University, 1964

Ph.D., Engineering Mechanics, Iowa State University of Science and Technology, 1968

Service on this faculty: 3 years

Original appointment: September 2003

Promotions: None

Other related experiences:

Academic:

Visiting Professor, Department of Mathematics, Politecnico de Torino, Torino, Italy, 1990

Professor, Department of Mechanical and Aerospace Engineering, University of Missouri-Rolla, 1988-2000

Professor, Department of Engineering Mechanics, University of Missouri-Rolla, 1977-1988

Associate Professor, Department of Engineering Mechanics, University of Missouri-Rolla, 1973-1977

Assistant Professor, Department of Engineering Mechanics, University of Missouri-Rolla, 1967-1973

Industrial:

NRC Senior Post-Doctoral Research Associate, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH, 1999 and 2000

AFOSR Visiting Scientist, Armstrong Laboratory, Wright-Patterson Air Force Base, OH, 1986-88

Visiting Scientist, IBM Corporation, Charlotte Research Laboratory, Charlotte, NC 1984-85

NRC Senior Post-Doctoral Research Associate, Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, OH, 1974-76

Consulting:

IBM Corporation, Charlotte, NC (1985, 1986)

IBM Corporation, Information Products Division, Lexington, KY (1983)

University of Dayton, Dayton, OH(Contractual Agreement with Wright-Patterson AFB) (1978,1979, 1985)

Professional registration:

Engineering Part I, State of Missouri

Principal publications, 2001-2005

- “Motion of a Cylinder Partially Filled With a Nano-Ferro-Fluid Suspension in a Magnetic Field, Nanotech 2005, Vol. 3, pp. 740-743, 2005
- “Airbag Deployment for Protection of Disabled Aircraft and Helicopters Operating at Sea”, Proceedings of 2003 SAFE-Europe Symposium, Munich, Germany, April 1-2, 2003.
- “An Integrated Optimization System for Airbag Design and Modeling by Finite Element Analysis”, Presented at the SAE World Congress, Detroit, Michigan, March 3-6, 2003.
- “Theoretical Foundation for the Operation of Liquid-Filled Anti-G Suit in Aviation”, Survival And Flight Equipment Symposium, Jacksonville, Florida, October 1-2, 2002; Published January 2003.
- "Submerged Inflatable Membrane Model of a Liquid-Filled Anti-G Suit", SAFE (Europe)-2002 Symposium Proceedings, Paper No. 4, Stockholm, Sweden, March 2002.
- "Mathematical Modelling", Encyclopedia of Physical Science and Technology, Third Edition., Volume 9, pp. 219-230, 2002.

Scientific and professional society membership:

Member, American Society of Mechanical Engineers (ASME)

Member, Association of Computing Machinery (ACM)

Honors and awards:**Courses taught during most recent academic year 2005-2006:****Fall semester:**

MAE 5902 “Micro-Electro-Mechanical Systems – I”, 3 hrs/wk lecture, day, graduate and senior undergraduate

JME 3221 “Mechanical Design and Machine Elements” 3hrs/wk lecture, day, undergraduate

Spring semester:

MAE 5903 “Micro-Electro-Mechanical Systems – II”, 3 hrs/wk lecture, day, graduate and senior undergraduate

MAE 141 D “Introduction to Engineering Design”, 4hrs/wk, two sections, day and evening, undergraduate freshmen

Other assigned duties: none

Participation in specific professional development programs:

Carbon Nanotubes Workshop, NanoScience and Technology Institute, Boston, March 2004.

ANSYS Multiphysics in Microsystems Software Workshop, NanoScience and Technology Institute, Boston, March 2004.

Nano-Bio-Microfluidics Tutorial, NanoScience and Technology Institute, Boston, March 2004.

Engineering and Designing of Smart Structures Short Course, Virginia Polytechnic Institute and State University, May 2000.

Micro-Electro-Mechanical Systems (MEMS): Design, Fabrication and Packaging. Berkeley Summer Institute 2000, University of California, Berkeley, June 2000.

BioMEMS, Berkeley Summer Institute 2000, University of California, Berkeley, June 2000.

Other duties: None

CURRICULUM VITAE

Name: Richard L. Axelbaum

Date of birth: 9 May 1955

Academic rank: Associate Professor, full time

Degrees:

Ph.D. in Mechanical Engineering, University of California, Davis, California, 1988

M.S. in Mechanical Engineering, University of California, Davis, California, 1983

B.S. in Mechanical Engineering, Washington University, St. Louis, Missouri, 1977

Service on this faculty: 16 years

Original appointment: September 1990, Assistant Professor

Promotions: July 1996, Associate Professor

Other related experiences:

Academic:

1988 – 1990, Research Associate/Lecturer, Department of Mechanical and Aerospace Engineering, Princeton University, Princeton, NJ

Industrial:

1983 – 1985 Research Engineer Air Quality Group, Department of Physics, University of California, Davis.

1978 – 1981 Technical Supervisor, Technapac, Inc., St. Louis, Missouri.

1977 – 1978 Field Engineer, General Electric - Power Generation Division, St. Louis, MO

Consulting: Expert Witness - cause and origin of fire and fire damage.

Professional registration: EIT, 1977

Principal publications:

Peer-Reviewed Articles and Book Chapters

1. Unrau, C.J., **Axelbaum, R.L.**, Biswas, P.B., and Fraundorf, P., “Online Size Characterization of Fibers and Nanotubes,” To appear in *Molecular Building Blocks for Nanotechnology: From Diamondoids to Nanoscale Materials and Applications*, G.A. Mansoori, T.F. George, G. Zhang, L. Assoufid, Eds., Topics in Applied Physics Series, Springer-Verlag, New York.
2. Kumfer, B.M., Skeen, S.A., Chen, R. and **Axelbaum, R.L.**, “Measurement and Analysis of Soot Inception Limits of Oxygen-Enriched Coflow Flames,” To appear in *Combustion and Flame*.
3. Barr, J.L., **Axelbaum, R.L.** and Macias, M.E., “Processing Salt-Encapsulated Nanoparticles for High-Purity, Ultrahigh Surface Area Applications,” *Journal of Nanoparticle Research* (2006).

4. Chen, R. and **Axelbaum, R.L.**, "Scalar Dissipation Rate at Extinction and the Effects of Oxygen-Enriched Combustion," *Combustion and Flame* 142 62-71 (2005).
5. Liu, S., Chao, Beei-Huan and **Axelbaum, R.L.**, "A Theoretical Study on Soot Inception in Spherical Burner-Stabilized Diffusion Flames," *Combustion and Flame* 140 1-23 (2005).
6. Sun, Z., **Axelbaum, R.L.** and Davis, R.W., "A Sectional Model for Investigating Microcontamination in a Rotating Disk CVD Reactor," *Journal of Aerosol Science and Technology* 38 1161-1170 (2004).
7. Sun, Z., **Axelbaum, R.L.** and Huertas, J.I., "Monte Carlo Simulation of Multicomponent Aerosols Undergoing Simultaneous Coagulation and Condensation," *Journal of Aerosol Science and Technology* 38 963-971 (2004).
8. Sunderland, P.B., Urban, D.L., Stocker, D.P., Chao, B.-H. and **Axelbaum, R.L.**, "Sooting Limits of Microgravity Spherical Diffusion Flames in Oxygen-Enriched Air and Diluted Fuel" *Combustion Science and Technology*, 176 2143-2164 (2004).
9. Sunderland, P.B., **Axelbaum, R.L.**, Urban, D.L., Chao, B.H. and Liu, S., "Effects of Structure and Hydrodynamics on the Sooting Behavior of Spherical Microgravity Diffusion Flames" *Combustion and Flame*, 132:1/2 25-33 (2003).
10. Rosen, L.J. and **Axelbaum, R.L.**, "Suppression of Cellular Structure in Slot Burner Flames," *Combustion and Flame*, 126: 1433-1444 (2001).
11. **Axelbaum, R.L.** and Moore, J.J., "Microgravity Combustion for Material Synthesis," in *Microgravity Combustion*, H.D. Ross, Ed., Academic Press, London (2001).
12. Liu, S. Chao, B.H. and **Axelbaum, R.L.**, "On Combustion with Condensed Phase Products: Applications to Droplet Burning of Magnesium in Carbon Dioxide," *Combustion and Flame*, 170: 35 (2001).

Scientific and professional society membership:

American Society of Mechanical Engineers
 Combustion Institute
 American Association for Aerosol Research
 Sigma Xi

Courses taught during most recent academic year 2005-2006:

Fall semester 2005:

MAE 448A; Combustion and Environment 3 credits, day course
 ENVE/MAE/CHE 564; Topics in Nanotechnology 3 credits, (taught one-third) day course
 ME 163; Introduction to Nanotechnology (taught 3 lectures), day course

Spring semester 2006:

MAE 321; Energetics 3 hours/week, day course
 ENVE/MAE 592; Advanced Topics in Aerosol Science and Engineering 3 credits, (taught one-third) day course

Other assigned duties:

School of Engineering and Applied Science Undergraduate Board (1991-present)
 Mechanical Engineering Written Qualifying Examination Committee (1991-present)
 Environmental Engineering Written Qualifying Examination Committee (2002-present)

Participation in specific professional development programs, since 2001: None

Other duties:

Associate Director of the Center for Materials Innovation (2005-present)
 Director of NASA Missouri Space Grant Consortium for WU Engineering (1997-present)

CURRICULUM VITAE

Name: Philip V. Bayly

Date of birth: 28 March 1965

Academic rank: Professor, full-time

Degrees:

A.B., Engineering Science, Dartmouth College, 1986
M.S., Engineering, Brown University, 1987
Ph.D., Mechanical Engineering, Duke University, 1993

Service on this faculty: 12 years

Original appointment: December 1993, Assistant Professor

Promotions: To Associate Professor (with tenure), July 1999. To Professor, January 2003

Other related experiences:

Academic:

None

Industrial:

Engineer, Pitney Bowes, Inc., 1989-1990
Research Engineer, Shriners Hospital, 1988-1989
Engineer, Connecticut Department of Environmental Protection, 1987-1988

Consulting:

Anheuser-Busch, Inc.: Analysis of shipping vibration measurements; accelerometer testing.
McDonnell Douglas Aerospace: Machine tool dynamics and stability.
Emerson Motor Company: Electric motor vibration modeling and analysis.
Ameren UE: Measurement and analysis of heat exchanger vibration.

Patents:

W. J. Kulpa, W. D. Toth, P. V. Bayly, J. Guiles, M. J. Brigante and J. Morabito, "Document Aligning Apparatus," US Patent #5080660, 1992.

J.E. Halley, J.J. Luner, K.A. Young, P.V. Bayly, "Force balanced irregular pitch reamer and associated reaming method," US Patent #6379090, 2002.

Professional registration:

None

Principal publications, 2000-2005:

A.R. Barnette, P.V. Bayly, S. Zhang, G.P. Walcott, R.E. Ideker, and W.M. Smith. "Estimation of 3-D conduction velocity vector fields from cardiac mapping data," *IEEE Trans Bio Engr* 47:1027-1035, 2000.
P.V. Bayly, K.A. Young, J.E. Halley, and S. Calvert. "Analysis of tool oscillation and hole roundness error in a quasi-static model of reaming," *J Mfg Sci Engr* 123:387-395, 2001.

P.V. Bayly, S.A. Metzler, A.J. Schaut, and K.A. Young. "Theory of torsional chatter in twist drills: model, stability analysis, and comparison to test," *J Mfg Sci Engr* 123:552-561, 2001.

P.V. Bayly, M.T. Lamar, S.G. Calvert, "Low frequency regenerative vibration and the formation of lobed holes in drilling," *J Mfg Sci Engr* 124:275-285, 2002.

T. Insperger, B.P. Mann, G. Stepan, P.V. Bayly. "Stability of up-milling and down-milling. Part I: Alternative analytical methods; Part II: Experimental verification" *Int J Mach Tools Mfg*, 43:25-40, 2003.

P.V. Bayly, J.E. Halley, Brian P. Mann, and M.A. Davies. "Stability of interrupted cutting by temporal finite element analysis," *J Mfg Sci Engr*, 125:220-225, 2003.

T. Insperger, G. Stepan, P.V. Bayly, B.P. Mann. "Multiple chatter frequencies in milling process," *J Sound Vib*, 262(2): 333-345, 2003.

R. Naunheim, P.V. Bayly, J. Standeven, J.S. Neubauer, L. Lewis, G.M. Genin. "Linear and angular head accelerations during heading of a soccer ball," 35(8):1406-12, *Med Sci Sports Exer*, 2003.

W. Liu, J. Chen, S. Ji, S. Allen, P.V. Bayly, S.A. Wickline, X. Yu. "HARP MRI tagging for direct quantification of Lagrangian strain in rat hearts after myocardial infarction," *Mag Res Med*, 52(6):1282-1290, 2004.

A. Nekouzadeh, G.M. Genin, P.V. Bayly, E.L. Elson. Wave motion in relaxation-testing of nonlinear elastic media. *Proc Roy Soc Lond A*, 461(2058), 1599-1626, 2005.

P.V. Bayly, E.E. Black, R.C. Pedersen, E.P. Leister, G.M. Genin. In vivo imaging of rapid deformation and strain in an animal model of traumatic brain injury. *J Biomech* 39:1086-1095, 2006.

P.V. Bayly, T.S. Cohen, E.P. Leister, D. Ajo, E. Leuthardt, and G.M. Genin. Deformation of the human brain induced by mild acceleration. *J Neurotrauma*. 22(8):845-856, 2005.

Scientific and professional society membership:

American Society of Mechanical Engineers
Biomedical Engineering Society

Honors and awards:

NIH Post-Doctoral Training Grant, 1993
CRAY Research Fellowship, 1993
NSF Career Award, 1996

Courses taught during most recent academic year 2005-2006:

Fall semester:

MAE 417 "Dynamics of Physical Systems," Lecture: 3 hours/week. Lab, 4 sections, day

Spring semester:

MAE 232 "Dynamics," 3 hours/week lecture, 1 section, day

Other assigned duties:

Academic advisor

Participation in specific professional development programs, since 1989:

Sabbatical year in laboratory of Dr. John W. Olney (Washington University School of Medicine)

Other duties:

None

CURRICULUM VITAE

Name: Thomas Bever

INDUSTRIAL EXPERIENCE:

Chas. S. Lewis, Inc.

Design and manufacture of chemical pumps

McDonnell Douglas Co. (Boeing)

Manufacturing of military aircraft and the Mercury and Gemini spacecraft.

Monsanto Electronic Materials Co. (MEMC)

Plant Engineering and Machine Design manager for semiconductor materials manufacturing

Weule Engineering

Chief Engineer – HVAC and piping design for commercial and industrial clients

Hunter Engineering Co.

Senior Project Engineer – Design and manufacture of automotive service equipment

Permea Division, Air Products & Chemicals Co.

Senior Project Engineer – Design and fabrication of manufacturing equipment facilities and systems

CDG Engineers

Senior Project Manager – Plant Engineering and design for clients in the Pharmaceutical and chemical industries.

Consulting Engineer, Self Employed (Thomas L. Bever, P.E.)

Forensic Engineering and expert witness services for law firms

Machine design for industrial clients

ACADEMIC EXPERIENCE:

Saint Louis University, Parks College 2002 – Present

Adjunct Professor, Mechanical Engineering & Aerospace Dept.

Foundation to Engineering Design – Sophomore level

Engineering shop Practices – Sophomore level

Capstone Design course (co-instructor) – Senior level

University of Illinois – Edwardsville 2000 – 2005

Adjunct Professor, Mechanical Engineering Dept.

Capstone Design course – Senior level

Static's & Dynamics – Senior level

Washington University in St. Louis 1992 – Present

Adjunct Professor, Mechanical and Aerospace Engineering Dept.

Introduction to Design – Freshman level

Capstone Design course – Senior level

Engineering Ethics – Senior level

American Society of Mechanical Engineers
“Fundamentals of Fastening Systems” 1994 – Present

Monsanto Company – Corporate Training Department
Problem solving consultant
“Analytical Problem Solving” instructor

MEMC Electronic Materials company
Established a Maintenance Training department
Taught Maintenance trade skills
Safety training classes
Presentation skills for trainers
New Employee Orientation class
Blueprint Reading

BACKGROUND AND EDUCATION:

BS degree in Mechanical Engineering
Washington University - St. Louis
Registered Professional Engineer
State of Missouri
48 years experience in machine design, plant engineering, management and training.

PROFESSIONAL SOCIETIES AND COMMUNITY SERVICE:

American Society of Mechanical Engineers
Lifetime Member
Chairman of St. Louis, Section 1978 & 1995
Continuing Education Instructor since 1994
St. Louis Academy of Science
Volunteer speaker
St. Louis Engineer’s Club
Member
VITA (Volunteers for International Technical Assistance)
Volunteer
Odyssey of The Mind
Regional Judge
Other - Volunteer design services for persons with disabilities
Home access renovation
Touch-screen computer support system
Leg braces and walker for use in swimming pool

CURRICULUM VITAE

Name: Harold J. Brandon

Date of birth: 13 February 1942

Academic rank: Affiliate Professor

Degrees:

B.S. 1963, Aeronautical Engineering, St. Louis University, St. Louis, MO

M.S. 1965, Engineering Science, St. Louis University, St. Louis, MO

DSc. 1969, Mechanical Engineering, Washington University, St. Louis, MO

Service on this faculty: 27 years

Original appointment: September 1979

Other related experiences:

Academic:

1969	Purdue University, Instructor
1972-1979	University of Missouri-Rolla Graduate Engineering Center
1973-1978	Lecturer (Mechanical Engineering)
1978-1979	Affiliate Associate Professor (Mechanical Engineering)
1979-present	Washington University
1979-present	Affiliate Professor (Mechanical Engineering)
1984-1985	Visiting Professor (Mechanical Engineering)
1994-1998	Research Instructor (Department of Surgery)
1998-present	Research Assistant Professor (Department of Surgery)

Industrial:

1963-1965	McDonnell Aircraft, Test Engineer
1968-1971	Allison Division of General Motors, Senior Research Engineer
1972-1978	McDonnell Douglas, Technical Specialist/Program Manager
1978-1984	Barry-Wehmiller Company
1978-1979	Chief Engineer
1979-1984	Director of Research & Development
1984-present	Brandon Research Inc., Owner

Principal publications (2001-2006):

- (i) Brandon HJ, Young VL, Jerina KL, Wolf CJ. "SEM Characterization of Surgical Instrument Damage to Breast Implants," *Plast Reconstr Surg*. Vol. 108, No. 1, July 2001.
- (ii) Brandon HJ, Young VL, Jerina KL, Wolf CJ. "Variability in the Properties of Silicone Gel Breast Implants," *Plast Reconstr Surg* Vol. 108, No. 3, pp. 647-655, Sept. 2001.
- (iii) Wolf CJ, Jerina KL, Brandon HJ, Young VL.. "The Transport of Octamethylcyclotetrasiloxane (D₄) and Polydimethylsiloxane (PDMS) in Lightly Cross-linked Silicone Rubber," *J. Biomater. Sci. Polymer Edn*, Vol. 12, No. 7, pp. 801-815, 2001.
- (iv) Brandon HJ, Young VL, Jerina KL, Wolf CJ. "In Vivo Aging Characteristics of Silicone Gel Breast Implants Compared to Lot-Matched Controls," *Plast. and Reconstr. Surg.*, Vol. 109, No. 6, pp. 1927-1933, 2002.
- (v) Wolf CJ, Jerina KL, Brandon HJ, Young VL. "The Effect of Cyclic Swelling (Octamethylcyclotetrasiloxane) on the Physical Properties of Silicone Breast Implant Shells," *J. Biomater. Sci. Polymer Edn*, Vol. 13, No. 1, pp. 27-41, 2002.

- (vi) Brandon HJ, Young VL, Wolf CJ, Jerina KL, Watson ME, McLaughlin JK. "Discussion of Silicone Gel Breast Implant Failure: Evaluation of Properties of Shells and Gels for Explanted Prostheses and Meta-Analysis of Literature Rupture Data," *Annals of Plastic Surgery*, Vol. 49, No. 3, pp. 16-21, 2002.
- (vii) Brandon HJ, Young VL, Jerina KL, Wolf CJ, Adams WP, Watson ME. "Mechanical Analysis of Explanted Saline-filled Breast Implants Exposed to Betadine Pocket Irrigation," *Aesth Surg J*, Vol. 22, No. 5, pp. 438-445, 2002.
- (viii) Brandon HJ, Jerina KL, Wolf CJ, Young VL. "Biodurability of Retrieved Silicone Gel Breast Implants," *Plast. and Reconstr. Surg.* Vol. 111, No. 7, June 2003.
- (ix) Brandon HJ, Young VL, Watson ME, Jerina KL, Wolf CJ. "Protocol for Retrieval and Analysis of Breast Implants," *J Long-Term Effects of Med Implants* 13:49-61, 2003.
- (x) Brandon HJ, Young VL, Wolf CJ, Jerina KL, Watson ME, McLaughlin JK. "Letter of Reply to the Discussion of Silicone Gel Breast Implant Failure: Evaluation of Properties of Shells and Gels for Explanted Prostheses and Meta-Analysis of Literature Rupture Data," *Annals of Plastic Surgery*, Vol. 51, No. 3, pp. 334-336, 2003.
- (xi) Young VL, Brandon HJ. "Physics of Liposuction," *Aesth Surg J*, Vol. 24, No. 3, pp 206-21, 2004.
- (xii) Brandon HJ, Jerina KL, Savoy TL, Wolf CJ. "Scanning Electron Microscope Fractography of Induced Fatigue-Damaged Saline Breast Implants," *J Long-Term Effects of Med Implants*, 16(1)73-84, 2006.

Awards:

1965-1966	Olin Grant, Washington University
1966-1968	NDEA Fellowship, Washington University
1974	"A Recirculating Combustion Apparatus Incorporating a Jet Pump," U. S. Patent
1982	"Filler Tube with Check Valve for Container Filling Devices," U. S. Patent
1982	Presidential Award from the Master Brewers Association of the Americas
1983	Presidential Award from the Master Brewers Association of the Americas
1984	Best Paper Award from the Society of Soft Drink Technologists

Professional registration: Registered Professional Engineer, Missouri

Courses taught during most recent academic year 2005-2006:

Summer semester:

JME 3210, "Energetics," 4 hours/week lecture.
 JME 4440, "Solar Energy," 10.5 hours/week lecture.

Fall semester:

MAE-581, "Air Conditioning Systems and Equipment," 3 hours/week lecture.

Spring semester:

MAE 582, "Air Conditioning Systems and Equipment," 3 hours/week lecture.

Other assigned duties: None

Participation in specific professional development programs, since 2001: None

Other duties: None

CURRICULUM VITAE

Name: Da-Ren Chen

Date of birth: 19 December, 1962

Academic rank: Associate Professor, full time

Degrees:

B.S., Power Mechanical Engineering, National Tsing-Hua University, 1985
M.S., Power Mechanical Engineering, National Tsing-Hua University, 1987
M.S., Mechanical Engineering, University of Minnesota, 1993
Ph.D., Mechanical Engineering, University of Minnesota, 1997

Service on this faculty: 4 years

Original appointment: July 2001, Assistant Professor

Promotions: Associate Professor, 2005

Other related experiences:

Academic:

Assistant Professor, Mechanical Engineering, University of Minnesota, 1998-2001
Manager, Particle Technology Laboratory, University of Minnesota, 1998-2001
Research Associate, Particle Technology Laboratory, University of Minnesota, 1997-1998
Instructor, Nanya Junior College of Technology, Taiwan, 1989-1991

Consulting:

Nanocopoeia, St. Paul, MN, 2001- now
W. L. Gore & Associates, Inc., Elkton, MD, 2005
Baxter Healthcare Corporation, Round Lake, IL, 2000-2002
Seagate Technology LLC, Longmont, CO, 2001-2002
TESCOM Corporation, Elk River, MN, 2000-2001
PICOGRAM, LLC, Los Altos Hills, CA, 2000
MTS Systems Corporation, Eden Prairie, MN, 1999

Professional registration: None

Principal publications, 2000-2005

- C.-J. Tsai, DA-REN CHEN, HungMin Chein, Sheng-Chieh Chen, Jian-Lun Roth, Yu-Du Hsu, Weiling Li. and P. Biswas, "Theoretical and Experimental Study of an Axial Flow Cyclone for Fine Particle Removal in Vacuum Conditions," *Journal of Aerosol Science*, 35, p1105-1118, 2004.
- Z. Gerald Liu, DA-REN CHEN, N. Perera, G. Pinggen, J. C. Lincoln and E. M. Thurow, "Transient Analysis of Engine Nanoparticles Using Fast Scanning Differential Mobility Particle Analyzer", SAE Paper #2004-01-0971, *SAE Transaction*.
- P. Lee, DA-REN CHEN and D. Y. H. Pui, "Experimental Study of a Nanoparticle Virtual Impactor," *Journal of Nanoparticle Research*, 5(3-4), p269-280, 2003.
- Yoshiyuki Endo, DA-REN CHEN, and D. Y. H. Pui, "Theoretical Consideration of Permeation Resistance of Fluid through a Particle Packed Layer," *Powder Technology*, 124, 119-126, 2002.
- Sintaro Sato, DA-REN CHEN, and D. Y. H. Pui, "A Novel Method for Producing Spatially Uniform Aerosol at the Low Pressure Environment," *Aerosol Science and Technology*, 36(2), 145-153, 2002.
- Yoshiyuki Endo, DA-REN CHEN and D. Y.H. Pui, "Air and Water Permeation Resistance across Dust Cake on Filters: Effects of Particle Polydispersity and Shape Factor", Special Issue in Memory of Dr. Iinoya, *Powder Technology*, 118(1-2), 24-31, 2001.

- K. S. Woo, DA-REN CHEN, D. Y. H. Pui and P. H. McMurry, "Measurements of Atlanta Aerosol Size Distribution: Observation of Ultrafine Particle Events," Special Issue on Particulate Matter and Health: The Scientific Basis for Regulatory Decision, Aerosol Science and Technology, 34(1), p75-87, 2001.
- P. H. McMurry, K. S. Woo, R. Weber, DA-REN CHEN, and D. Y. H. Pui, "Size distributions of 3-10 nm atmospheric particles: implications for nucleation mechanism," Phil. Trans. R. Soc. Lond. A, 358, p2625-2642, 2000.
- DA-REN CHEN, C. H. Wendt and D. Y. H. Pui, "A Novel Approach for Introducing Bio-material into Cells," J. of Nanoparticle Research, 2, p133-139, 2000.
- Hee-Siew Han, DA-REN CHEN, and D. Y. H. Pui, "A Nanometer Aerosol Size Analyzer for Rapid Size Distribution Measurements", J. of Nanoparticle Research, 2, p43-52, 2000.

Scientific and professional society membership:

American Association for Aerosol Research (AAAR)
 Germany Association for Aerosol Research (Gaef)
 American Filtration and Separation Society (AFS)
 Chinese Association for Aerosol Research in Taiwan (CAART)
 American Society for Mechanical Engineering (ASME)
 Fiber Society

Honors and awards:

Smoluchowski Award (GaeF Award) for Significant Contribution on Nanoparticle Instrumentation, 2002
 NSF Travel Awards for International Symposiums on Nanoparticles, 1999-2002
 3M Non-tenured Faculty Awards, 1999-2000
 Sheldon K. Friedlander Award (AAAR Award), 1997
 (The Sheldon K. Friedlander Award recognizes an outstanding dissertation by an individual who has earned a doctoral degree. This is the INAUGURAL year for this award).
 American Filtration and Separation Society Fellowship Award, 1997
 Doctorial Dissertation Fellowship (U of MN), 1996
 Rosement Instrument Award (Mechanical Engineering), 1995

Courses taught during most recent academic year 2005-2006:

Fall semester:

ME 370 "Fluid Mechanics" 3 hrs/wk lecture, day, undergraduate
 CE 583 "Transport in the Environment", 3 hr/wk lecture, graduate

Spring semester:

ME 563 "Measurement Techniques for Aerosol Studies", 3 hrs/wk, lecture and lab, day, graduate/senior elective, offered every even year
 ME 564 "Topics in Nanotechnology", 3 hrs/wk, team teaches, lecture, day, graduate/senior elective, offered every odd year
 ME 592 "Advanced topics in Aerosol", 3 hrs/wk, team teaches, lecture, day, graduate/senior elective, offered every even year
 ME 263 "Intermediate Nanotechnology", 3 hr/wk, team teaches, lecture, day, undergraduate, 2005.

Other assigned duties: None

Participation in specific professional development programs, since 2000: None

Other duties: None

CURRICULUM VITAE

Name: Jerry W. Craig

Date of birth: 2 December 1934

Academic rank: Affiliate Professor

Degrees:

B.S., Ind. Ed. Northeast Missouri State University, 1957

M.S., Tech. Ed. Pittsburg State University, Kansas, 1972

Service on the faculty: 48 years full time and part time

Original appointment: September, 1957, Instructor

Other related experiences:

Academic:

Department Chairman, Engineering Graphics, St. Louis Community College. 25 Years.

Industrial:

General Engineering, McDonnell-Douglas Aircraft. Six years.

COMTEK (My own company), five years, computer programming, electronic control design.

Consulting:

Art Welding Company, three years, computer programming, product design.

Progressive Recovery Co. five years, computer programming, product design.

McDonnell-Douglas Co. one year, special projects.

Professional registration:

None

Principal publications, 1993-2006:

"Engineering Graphics Problems," 1993-1994 ISBN 0-30-000808-4 Published by Schroff Development.

Presented Paper "Practical Design Projects for a First Graphics Course" A.S.E.E. convention, Edmonton Canada, June 1994.

"An Introduction to Engineering Design" 1995, 2005

"Engineering and Technical Drawing Using AutoCAD" 1996, 2006

"Engineering and Technical Drawing Using SilverScreen 1997

"Engineering Graphics Text/Workbook series 2", 1999

"Engineering Graphics Technical Sketching, 2005

"Engineering and Technical Drawing using AutoCAD v14", 1999

"AutoCAD Essentials", 2006

"Engineering and Technical Drawing using Solid Edge" 1999 - 2006 V5, V6, V8, V9, V10, V12, V14, V16

"IronCAD and INOVATE", 1999 - 2006 V2, V3, V4, V5, V6, V7

Scientific and professional society membership:

A.S.E.E, Engineering Graphics and Design divisions.
American Institute for Design and Drafting.

Honors and awards:

"Outstanding Teacher" 1991, St. Louis Community College

Courses taught during most recent academic year:

Fall 2005 semester:

CE/ME145 Engineering Graphics - 3 sections
ME 141 Introduction to Engineering Design - 2 sections

Spring 2006 semester:

CE/ME145 Engineering Graphics - 2 sections
ME 141 Introduction to Engineering Design - 3 sections

Other assigned duties:

None

Participation in specific professional development programs since 1983:

AutoCAD Computer Aided Design and Drafting Software:

1987, training seminar, Sausalito CA, taught local professional courses
1988, training seminar, Sausalito CA, taught local professional courses
1989, training seminar, Sausalito CA, taught local professional courses
1990, training seminar, Sausalito CA, taught local professional courses
1991, training seminar, Sausalito CA, taught local professional courses
1992, training seminar, Sausalito CA, taught local professional courses

"Training the Trainers" professional training for teachers: 1989, 1990, 1991, taught special courses.

"Silver Screen" Computer Aided Solids Modeling software: Attended training courses 1989, 1991, 1992.

"Unigraphics" Hybrid Modeling, "Unigraphics" Drafting Training 1997.

Solid Edge Instructor Training 1998, Iron Cad Instructor Training 1999.

I am past National Chairman of the Solid Edge Academic User Group.

Other duties: none

CURRICULUM VITAE

Name: Eliot Fried

Date of birth: 12 October 1959

Academic rank: Associate Professor, full time

Degrees:

A.B., Oriental Languages, University of California, Berkeley, 1981

B.S., Applied Mathematics, California Polytechnic State University, San Luis Obsipo, 1986

M.S., Applied Mechanics, California Institute of Technology, 1989

Ph.D., Applied Mechanics, California Institute of Technology, 1991

Service on this faculty: 4 years

Original appointment: April 2002, Associate Professor

Other related experiences:

Academic:

Postdoctoral Research Associate, Center for Nonlinear Analysis, Carnegie Mellon University, 1991-1992

Assistant Professor of Engineering Science and Mechanics, Pennsylvania State University, 1992-1995

Visiting Assistant Professor, Department of Mathematics, Carnegie Mellon University, 1995

Assistant Professor of Theoretical and Applied Mechanics, University of Illinois at Urbana-Champaign, 1995-1999

Associate Professor of Theoretical and Applied Mechanics, University of Illinois at Urbana-Champaign, 1999-2003

Industrial:

IBM Watson Laboratories, Summer 1996.

Consulting: N/A

Professional registration: N/A

Principal publications, 2001-2006

Fried, Eliot and Gurtin, Morton E., "A unified treatment of evolving interfaces accounting for deformation and atomic transport with emphasis on grain-boundaries and epitaxy," *Advances in Applied Mechanics*, vol. 40, 2004.

Dolbow, John, Fried, Eliot and Ji, Huidi, "Chemically-induced swelling of hydrogels," *Journal of the Mechanics and Physics of Solids*, vol 52, 2004.

Fried, Eliot, Korchagin, Vladimir and Todres, Russel E., "Biaxial disclinated states in nematic elastomers," *Journal of Chemical Physics*, vol 119, 2003

Fried, Eliot and Gurtin, Morton E., "The role of configurational force balance in the nonequilibrium epitaxy of films," *Journal of the Mechanics and Physics of Solids*, vol 51, 2003.

Fried, Eliot, "An elementary molecular-statistical basis for the Mooney and Rivlin--Saunders theories of rubber elasticity," *Journal of the Mechanics and Physics of Solids*, vol. 50, 2002.

Fried, Eliot and Todres, Russell E., "Normal-stress differences and the detection of disclinations in nematic elastomers," *Journal of Polymer Science B: Polymer Physics*, vol. 40, 2002.

Fried, Eliot and Todres, Russell E., "Prediction of disclinations in nematic elastomers," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 98, 2001.

Cermelli, Paolo and Fried, Eliot, "The evolution equation for a disclination in a nematic liquid crystal," *Proceedings of the Royal Society of London A*, vol. 458, 2001.

Fried, Eliot and Gurtin, Morton E., "Coherent solid-state phase transitions with atomic diffusion: a thermomechanical treatment," *Journal of Statistical Physics*, vol. 95, 1999.

Fried, Eliot and Grach, German., "An order-parameter based theory as a regularization of a sharp-interface theory for solid-solid phase transitions," *Archive for Rational Mechanics and Analysis*, vol. 138, 1997.

Scientific and professional society membership:

American Physical Society
American Academy of Mechanics
Society for Natural Philosophy

Honors and awards:

Member Sigma Xi
Critical Research Initiative Grant, University of Illinois, 2001-2003
Fellow, Center for Advanced Study, University of Illinois, 1999-2000
Incomplete List of Teachers Ranked as Excellent by Their Students, University of Illinois, Spring 1996, Fall 1996, Fall 2000
National Science Foundation Mathematical Sciences Postdoctoral Research Fellowship, 1992-1995
Japan Society for the Promotion of Science Postdoctoral Fellowship, 1992-1993
Charles Lee Powell graduate Fellowship, California Institute of Technology, 1990-1991
California Institute of Technology Scholarships, 1996-2000
Graduated with Highest Honors, California Polytechnic State University, 1986
Outstanding Student in the School of Science and Mathematics, California Polytechnic State University, 1986
Annual Award for Excellence in Mathematics, California Polytechnic State University, 1985-1986
Graduated with Honors, University of California, Berkeley, 1981.

Courses taught during most recent academic year 2004-2005:**Fall semester:**

ME 320A "Thermodynamics," 3 hrs/wk lecture, day, undergraduate

Spring semester:

ME 540 "Continuum Mechanics," 3 hours/week lecture, night graduate/senior elective

Other assigned duties: Freshman Advisor, 2003-present

Participation in specific professional development programs, since 1995: None

Other duties: None

CURRICULUM VITAE

Name: Michael G. Gaffney

Date of birth: 9 January 1960

Academic rank: Adjunct Professor

Degrees:

Masters Business Administration (MBA) - *University of Bridgeport, CT*; 1987

Bachelor of Science (BS) - *Aerospace Management - Parks College of St. Louis University*; 1981.

Service on this faculty: 2+ years

Original appointment: August 2004

Other related experiences:

Academic:

1979 - Present: Certified Flight Instructor – Federal Aviation Administration (FAA)

2005: Adjunct Professor – St. Louis University – Teaching Advanced Avionics and Cockpits Class

Industrial:

Skyline Aeronautics – *President* - (April 2002 – Present)

Flightlogics (*a division of Skyline Aeronautics*) – *Chief Technology Architect* - (April 2002 – Present)

Oracle Corporation – *Director-Consulting Business Development* - (Feb 2001 – April 2002)

KPMG Consulting – *Manager-Business Development* - (Aug 99 – Feb 2001)

Compuware Corporation – *Manager-Application Solutions* - (Feb 97 – Aug 99)

Texas Instruments Software - *Account Manager* - (May 1995 – Feb 97)

Unibased Systems Architecture, Inc. - *Senior Sales Consultant* -(Sept. 1994 -May 95).

Cap Gemini America - *Account Executive* -(Dec. 1988 - Sept. 1994).

McDonnell Douglas Corporation - *Section Manager - Systems Analysis* (July 85 - December 88).

Sikorsky Aircraft of United Technologies - *Logistics Management (ILS) Staff Specialist* - (August 1981 - July 1985) -

Principal publications:

<i>Diamond G1000: Glass with Class</i>	Gaffney	Diamond Quarterly Magazine - July 2006 (pending);
<i>How Well Do You Know Your Electrical System?</i>	Gaffney	June 2006 (pending Pub Announcement);
<i>No Going Back</i>	Gaffney	FAA News - Oshkosh 2006 issue (pending);
<i>The Complete G1000 - Interactive Software</i>	Gaffney	ASA Publications- Interactive Software Series (April 2006);
<i>Is Your Aircraft Ready for Spring?</i>	Gaffney	American Cessna Club - Spring 06;
<i>Pilot Transition to TAA Aircraft featuring the Garmin G1000 Glass Cockpit</i>	Gaffney	American Cessna Club; National Association of Flight Instructors Mentor <i>Sept-05</i>
<i>Teaching Kids to Fly with a Joystick</i>	Gaffney	FAA News Jan/Feb 06 issue NAFI Mentor - Feb 06
<i>FITS Based Scenario Training - Are we ready for this?</i>	Gaffney	FAA News - Nov/Dec 05 Issue

<u>Operations at Non-towered Airports</u>	Gaffney	Midwest Aviation Journal; Avemco Newsletter; American Cessna Club
<u>Liftoff</u>	Cynthia Wilson	St. Louis Post Dispatch 04/02
<u>Mike Gaffney Designated Master Flight Instructor</u>	NAFI	National Association of Flight Instructors Press Release 6/05
<u>Do Advanced Avionics Make Better Pilots?</u>	Smith	Quoted in article-Avionics News Publication 10/05

Awards:

- Designated as Flight Instructor of the year for 2006 by the Greater St. Louis Flight Instructor's Association
- 22 CFR Part 141 TCOs and Syllabi accepted and approved by FAA, St. Louis FSDO *Certificate Issued 08/2005*
- Became first flight training company in US to receive 4 FAA FITS Syllabi accepted and approved by FAA in Washington DC that were also Part 141 Approved, *Acceptance Letter Issued 03/2006*
- FAA Aviation Safety Counselor – *Designated 10/2003*
- FAA Diamond Award recipient for Maintenance Excellence – *Letter issued 2/2005 and 2/2006*
- FAA Gold Seal Flight Instructor – *Designated 2/26/2005*
- Chief Flight Instructor – Skyline Aeronautics High Technology Programs
- Chief Flight Instructor – Skyline Aeronautics – Washington University Satellite facility- designated per FAA CFR Part 141
- Washington University Adjunct Professor – Sept 2004 – Present
- St. Louis University Adjunct Professor – Feb 2006 - Present
- Master Flight Instructor –*Designation by National Assoc. of Flight Instructors May 2005*
- Presenter – Sun N Fun 2006 – *Lakeland, FL April 4-7, 2006*
- Presenter – AirVenture 2005 – *Oshkosh, Wisconsin July 29, 2005*
- Cessna FITS Accepted Instructor (CFAI) – *Designation received Jan 2005*
- Diamond Aircraft Fits and Factory Authorized Instructor (DFAI) – *June 2005*
- FAA/Industry Training Standard (FITS) A001C Course Acceptance *Designation letter from FITS Program Manager received February 2005*
- FAA/Industry Training Standard (FITS) A003G Course Acceptance *Designation letter from FITS Program Manager received February 2005*

Professional registration: None

Courses taught during most recent academic year 2005-2006:

Fall semester:

E67-147 “Private Pilot Ground School”

Spring semester:

E67-147 “Private Pilot Ground School”

Other assigned duties: None

Participation in specific professional development programs, since 2001: Master Flight Instructor Certification Program – National Association of Flight Instructors Designated May 2005 – Exp May 2007

Other duties: None

CURRICULUM VITAE

Name: Richard A. Gardner

Date of birth: 6 December 1941

Academic rank: Professor, full time

Degrees:

B.S., Engineering Sciences, Purdue University, 1963

M.S., Engineering, Purdue University, 1965

Ph.D., School of Aeronautics Astronautics and Engineering Science Department, Purdue University, 1969

Service on this faculty: 29 years

Original appointment: September 1969, Assistant Professor

Promotions: July 1975, Associate Professor, July 1997, Professor

Other related experiences:

Academic:

Assistant Professor, Purdue University, 1969

Associate Professor, University of Wyoming, 1982-1983

Assistant Department Chairman, Washington University, 1989-1995, 1997-

Industrial:

None

Consulting:

Applied Mechanics Reviews, 1973-1982

Prentice-Hall, Macmillan, West Educational Publishing, 1986-present

Eng. analysis measurements, and expert opinions for industrial and legal firms, 1969-present

Professional registration:

Missouri, E-15736

Montana, 8387E

Principal publications, 1989-1994:

H.-C. Ji and R. A. Gardner, "Numerical Analysis of Turbulent Pipe Flow in a Transverse Magnetic Field," Int. J. Heat and Mass Transfer, Vol. 40, No.8, pp. 1839-1851, 1997.

M. J. Al-Khawaja, R. K. Agarawal and R. A. Gardner, "Numerical Study OF MFM COMBINED FREE-AND-FORCED CONVECTION HEAT TRANSFER

Scientific and professional society membership:

American Institute of Aeronautics and Astronautics
American Society of Mechanical Engineers
Sigma Xi

Honors and awards:

Class Valedictorian, 1959
Lions Club Outstanding Student, 1959
B.Sc. E.Sc. with Distinction, 1963, Purdue University
Tau Beta Pi
Sigma Pi Sigma
Pi Tau Sigma
Douglas Fellow, 1964
Ralph R. Teetor Teaching Award, 1970
Listed in several "Who's Who"

Courses taught during most recent academic year 2005-2006:**Fall semester:**

MAE 372B 3 hours lecture, 1 hour recitation, day course

Spring semester:

MAE 371 3 hours/week, 1 hour recitation, day course

Other assigned duties:

Assistant Department Chairman duties
 Prepare list of teaching assignment
 Determine course offerings each semester
 Schedule of courses each semester, summer
 Determine summer course offerings, schedule, instructors
 Employ teaching assistants for scheduled classes
 Advisor to transfer students, part time students
 Review B. S. candidates records for graduation, annual department awards

Participation in specific professional development programs, since 1989:

None

Other duties:

MAE coordinator for UMSL/WU B.S.M.E. program
Advisor to UMSL/WU students
Schedule UMSL/WU classes and instructors for Fall, Spring, Summer
WU Departmental Committees: qualifying exams, laboratory committee, M.S./D.Sc. advising committee
WU School Committees: Discipline, Safety, CO-OP

CURRICULUM VITAE

Name: Guy M. Genin

Date of birth: 29 October 1968

Academic rank: Assistant Professor, full time

Degrees:

B.S.E., Civil Engineering, Case Western Reserve University, 1991

M.S., Engineering Science, Case Western Reserve University, 1992

S.M., Engineering Sciences, Harvard University, 1993

Ph.D., Solid Mechanics, Harvard University, 1997

Service on this faculty: 7 years

Original appointment: September 1999, Assistant Professor

Other related experiences:

Academic:

Adjunct Professor, Cambridge University Engineering Department, 1997

Instructor, Queens' College, Cambridge University, 1997

Teaching Fellow, Harvard University, 1992-1995

Governmental:

Summer Associate, Los Alamos National Laboratory, 1988-1989

Consulting:

SiC/SiC composites, Dow Chemical 1996

Mechanical behavior of composite materials, Metal and Ceramic Composites Corp., Goleta, CA 1997-1999

Principal publications, 2001-2006

G. M. Genin and J. W. Hutchinson, "Failures at Attachment Holes in Brittle Matrix Laminates," *J. Composite Materials*, **33**(17), 1999, p. 1600-1619.

D. R. Cairns, G. M. Genin, A. J. Wagoner, C. L. Briant, G. P. Crawford, "Amplified Strain-Rate Dependence of Deformation in Polymer Dispersed Liquid Crystal Materials," *Applied Physics Letters*, **75**(13), 1999, p. 1872-1874.

J. McNulty, F. W. Zok, G. M. Genin, and A. G. Evans, "Notch-Sensitivity of Fiber-Reinforced Ceramic Matrix Composites: Effects of Inelastic Straining and Volume-Dependent Strength," to appear in *Journal of the American Ceramic Society*, **82**(5), 1999, p. 1217-28.

G. M. Genin and J. W. Hutchinson, "Composite Laminates in Plane Stress: Constitutive Modelling and Stress Redistribution Due to Matrix Cracking," *Journal of the American Ceramic Society*, **80**(5), 1997, p. 1245-55.

G. M. Genin and J. W. Hutchinson, "Composite Laminates in Plane Stress: Constitutive Modelling and Stress Redistribution Due to Matrix Cracking," in **High-Temperature Ceramic Matrix Composites I**, A.G. Evans and R. Naslain, ed., Westerville: The American Ceramic Society, 1995, p. 23-41.

R. Ballarini, G. M. Genin, and S. Gultop, "The Effect of Superimposed Hydrostatic Pressure on Deformation in Metal Matrix Composites," submitted to *Composite Engineering*.

G. M. Genin, N. A. Fleck, and D. Cebon. "Failure Mechanisms in Asphalt Concrete." University of Cambridge technical report. ISSN 0309-6505. Submitted to *International Journal of Road Materials and Pavement Design*.

Conference Papers:

J. D. Bressan, G. M. Genin, and J. A. Williams, "The Influence of Pressure, Boundary Film Shear Strength, and Elasticity on the Friction Between a Hard Asperity and a Deforming Softer Surface," in **Lubrication at the Frontier**, Dowson, et al., ed., Elsevier Science, 1999, p. 79-90.

Consulting Reports:

F. W. Zok, J. McNulty, G. M. Genin, A. G. Evans, and J. W. Hutchinson, "Influence of Holes on the Tensile Strength of a SiC/SiC Composite," 1996. Dow Chemical.

Scientific and professional society membership:

American Society of Mechanical Engineers
American Society of Civil Engineers
American Academy of Mechanics
Society of Engineering Science
Tau Beta Pi

Honors and awards, since 1995::

Derek Bok Undergraduate Teaching Award, Harvard

Courses taught during most recent academic year 1999-2000:

Fall semester:

MAE 232 "Dynamics," 3 hours/week lecture, day, undergraduate

Spring semester:

MAE 232 "Dynamics," 3 hours/week lecture, day, undergraduate

Other assigned duties:

None

Participation in specific professional development programs, since 1995:

Participated in International Mechanical Engineering Congress and Exhibition 1999, Nashville.

Other duties:

None

CURRICULUM VITAE

Name: John C. Georgian

Date of birth: 26 December 1912

Academic rank: Emeritus, part-time instructor

Degrees:

B.M.E. 1939, Mechanical Engineering, University of Minnesota.

M.S. 1941, Engineering, Cornell University.

Service on this faculty: 57 years

Original appointment: September 1949, Associate Professor

Promotions: Professor, July 1956; Emeritus, July 1981

Other related experiences:

Academic:

University of Minnesota, Minneapolis. 1936-1938. Assistant to Professor J.J. Ryan, in charge of machine design laboratory, including vibration models and photoelastic equipment

Cornell University, Ithaca, New York, September 1938-June 1940. Instructor in kinematics and machine design laboratory

West Allis Vocational School, 1941-43. Evening school instructor in graphics and kinematics.

University of Wisconsin Extension Division in Milwaukee, Wisconsin, 1944-1948. Evening school instructor for mechanical vibrations, applied elasticity, gas turbines, and jet propulsion.

Industrial:

Cumulative industrial experience of about 15 years 1939 to 1967. Main areas of activity: turbine design, engine vibration analysis.

Consulting: Over 100 industrial and legal clients since 1950.

Principal publications:

“Optimum Design of Variable Composite Flywheel” Journal of Composite Materials, 1989.

Honors and awards:

Washington University School of Engineering Professor of the Year, 1982.

Professional registration: Missouri, E-4407

Scientific and professional society membership:

American Society of Mechanical Engineers, American Society for Engineering Education, American Association of University Professors

Courses taught during most recent academic year 2005-2006:

Spring semester:

MAE 570 "Advanced Machine Design," 3 hours/week lecture.

Other assigned duties: None

Participation in specific professional development programs, since 2001: None

Other duties: None

CURRICULUM VITAE

Name: Mario P. Gomez

Date of birth: 26 February 1929

Academic rank: Affiliate Professor

Degrees:

Mechanical Engineering, University of Buenos Aires, 1953
M.Sc., Metallurgical Engineering, University of Washington, 1958
Ph.D., Materials Science, Stanford University, 1964

Service on this faculty: 28 years

Original appointment: January 1978-February 1983, Professor
February 1983-Present, Affiliate Professor

Promotions: None

Other related experiences:

Academic:

National Science Foundation & International Atomic Energy Commission (U.N.) Visiting Professor,
Institute of Physics, Bariloche, Argentina, 1964-1966
Agency for International Development (State Department) Visiting Professor, Middle East Technical
University, Ankara, Turkey, 1968-1970

Industrial:

39 years; machine design, materials engineering, failure analysis, CAD, CIM
President Alimar Systems Inc. and Vice President, Diagnostic Engineering, Inc.

Consulting:

Over one hundred companies and legal firms in the St. Louis area on problems related to machine design, CAD,
CIM, robotics, failure analysis, product liability, industrial automation, CIM, accident reconstruction, etc.

Professional registration:

Missouri, E-19007

Principal publications, 1993-1998:

None

Scientific and professional society membership:

American Society for Testing Metals
American Society for Metals
Instrument Society of America

Honors and awards: None

Courses taught during most recent academic year 2005-2006:

Summer:

JME 4250 Materials in Engineering Design

Spring semester:

MAE 575 Fluid Control & Power Systems, 3 hours/week lecture, 1 section, evening, graduate

Other assigned duties:

None

Participation in specific professional development programs, since 1989:

None

Other duties:

None

CURRICULUM VITAE

Name: Xian-Zhong Guo

Date of birth: August 20, 1962

Academic rank: Adjunct Professor

Degrees:

B.S. 1982, Mathematics, Nankai University, Tianjin, China.

M.S. 1985, Mathematics, Nankai University, Tianjin, China.

Ph.D. 1992, Applied mathematics, University of Maryland, College Park, MD.

Service on this faculty: 2 years

Original appointment: January 2005

Other related experiences:

Academic:

1994-Present: Adjunct Professor, Department Electrical and Systems Engineering, Washington University. Responsible of teaching the courses: ESE411/511 Numerical Methods, ESE512 Advanced Numerical Methods, ESE415/515 Optimization.

Industrial:

1992-1998, 2002-present: Senior Research Scientist, Engineering Software Research and Development, Inc., St. Louis, Missouri. Responsible for development of software related to the mathematical functionalities of *StressCheck*, a p-version finite element analysis program.

Principal publications:

- *Performance Enhancements and Parallel Algorithms for Two Multilevel Preconditioners* (with Howard Elman), SIAM J. Sci. Stat. Comput., 14:890-913, 1993
- *A Parallel Solver for the HP-Version of Finite Element Methods* (with Kent Myers), Comput. Methods Appl. Mech. Engrg., 133:229-246, 1996
- *Multi-p Preconditioners* (with N. Hu, I.N. Katz), SIAM J. Scientific Computing, 18:1676-1697, 1997.
- *Bounds for eigenvalues and condition numbers in the p-version of the finite element method* (with N. Hu, I.N. Katz), Math. Comp. 67 (1998), 1423-1450.
- *Performance Enhancement of the Multi-p Preconditioner*, Computers and Mathematics with Applications, vol 36, no 4, pp1-8, 1998.

Awards:

Awarded NSF SBIR grant for the Phase I project: "Parallel Solution Methods for hp-version Finite Element Analysis" (1992).

Professional registration: None

Courses taught during most recent academic year 2005-2006:

Fall semester:

ESE411/511: Numerical Methods

MAE265: Mechanical Engineering Computing

Spring semester:

ESE415/515: Optimization

MAE265: Mechanical Engineering Computing

Other assigned duties: None

Participation in specific professional development programs, since 2001: None

Other duties: None

CURRICULUM VITAE

Name: Raimo J. Hakkinen

Date of birth: February 26, 1926

Academic rank: Professor, part-time

Degrees:

Ph.D., (cum laude) in Aeronautics and Physics, California Institute of Technology, 1954.

M.S., in Aeronautics, California Institute of Technology, 1950.

Diploma (with honors) in Aeronautical Engineering, Helsinki University of Technology, Finland, 1948.

Service on this faculty: 7 years

Original appointment: 1991, Professor, part-time

Promotions None

Other related experiences:

Academic:

University of Jyväskylä, Finland. Visiting Lecturer, Department of Physics; special course in Experimental Fluid Dynamics, May 1996, May 1997 and May 1998.

Massachusetts Institute of Technology, Department of Aeronautics and Astronautics, Research Staff, 1953-1956, and Visiting Associate Professor, 1963-1964.

University of California at Los Angeles, Lecturer in Engineering (thermodynamics), 1957-1959

Tampere Technical College, Tampere, Finland; Instructor in Mechanical Engineering, 1949.

Industrial:

McDonnell Douglas Corporation, 1956 to 1990: McDonnell Douglas Astronautics Company Douglas Aircraft Missile and Space Systems Division, California; Aerodynamics Engineer, 1956-1964; Chief Scientist, Physical Sciences Department, 1964-1970; Director-Research, McDonnell Douglas Research Laboratories, St. Louis, 1970-1990; responsible for the Flight Sciences program of computational and experimental research.

U. S. Air Force Wright Laboratory, Summer Research Associate, 1993, 1994 and 1995

VALMET Corporation, Aircraft Division, Tampere, Finland; Design Engineer, 1949.

Finnish Aeronautical Association, Helsinki, Head of Technical Office, 1948. sailplane construction and airworthiness inspections.

Consulting:

Analytical Services & Materials, Inc., services to NASA-Dryden Flight Test Center, 1997 - .

Technology Development Centre (Tekes), Finland. International CFD program evaluation team, 1996-1997.

University of Dayton Research Institute, wind tunnel and flight instrumentation, 1990-1997.

Lincoln Laboratory, hypersonic aerodynamics, 1963-1964.

Professional registration: None

Principal publications:

Raimo J. Hakkinen, Charles Hirsch, Egon Krause and Harri K. Kytömaa, Computational Fluid Dynamics (CFD) Programme 1995-1999, Evaluation Report 1/97, Tekes, Helsinki, Finland, January 1997.

Hakkinen, R.J., Uncertainties in Measurement of Skin Friction with Conventional and Miniature Sensors, American Physical Society Fluid Dynamics Division Meeting, Syracuse, NY, November, 1996.

Hakkinen, R. J., Calibration of Surface Obstacle Devices as Skin Friction Meters, American Physical Society Fluid Dynamics Division Meeting, Irvine, CA, November, 1995.

Hakkinen, Raimo J., Design and Calibration of a New Surface-Obstacle Skin Friction and Flow Direction Meter, Proceedings, IEEE 16th International Congress on Instrumentation in Aerospace Simulation Facilities, Dayton, Ohio, July 18-21, 1995.

Calibration of Surface Obstacle Devices as Skin Friction Meters, American Physical Society Fluid Dynamics Division Meeting, Albuquerque, New Mexico, 21-23 November, 1993.

Scientific and professional society membership:

American Institute of Aeronautics and Astronautics

American Physical Society

Sigma Xi

Engineering Society in Finland

Honors and awards:

Helsinki University of Technology. Honorary Doctorate of Technology, September, 1998.

American Institute of Aeronautics and Astronautics: Elected Fellow, 1983. Director-at-Large, 1977-1979; Technical Activities Committee, 1974-78, Honors and Awards Committee, 1975-1983, and Technical Committee on Fluid Dynamics, 1967-1969. General Chairman of the 11th Aerospace Sciences Meeting, Washington, DC, 1973. Technical Management Award, St. Louis Section, 1983.

National Science Foundation, Review Committee for Young Presidential Investigator awards, 1989.

National Research Council, Review Panel for NASA's Numerical Aerodynamic Simulation Program, 1983.

Finnish Aeronautical Association Silver Medal of Merit, 1964.

Listed in Who's Who in America and American Men and Women of Science.

Courses taught during academic year 2005-2006:**Fall semester:**

JME 3721 "Fluid Mechanics Laboratory," 3 hours/week laboratory, one section, day, undergraduate
MAE 533 "Fluid Dynamics I," 3 hours/week lecture, 1 section, day, graduate.

Spring semester:

MAE/CE 372A "Fluid Mechanics Laboratory," 3 hours/week laboratory, three sections, day, undergraduate
MAE 534 "Fluid Dynamics II," 3 hours/week lecture, 1 section, day, graduate.

Other assigned duties: Mechanical Engineering Laboratory Committee

Participation in specific professional development programs: Teaching workshop, 1991

CURRICULUM VITAE

Name: Patrick T. Harkins

Date of birth: 6 September 1944

Academic rank: Instructor, part time

Service on this faculty: 18 years

Original appointment: April 1988, Technician

Other related experience:

Industrial : 20 years previous experience in industry

Honors and awards:

2002-2003 SEAS Outstanding Service Award

Courses taught during most recent academic year 1999-2000:

Fall semester:

ME 143A Machine Shop Practicum, 3 hours/week lab; 1 hour/week lecture, day, undergraduate

Spring semester:

MAE 143A Machine Shop Practicum, 3 hours/week lab; 1 hour/week lecture, day, undergraduate

MAE 204 Manufacturing Process, 3 hours/week lab, 1 section, day, undergraduate

Other assigned duties:

Machine Shop Manager

CURRICULUM VITAE

Rudolf B. Husar

Center for Air Pollution Impact and Trend Analysis (CAPITA), Campus Box 1124,
Washington University, St. Louis, MO 63130-4899.

Phone: (314) 935-6099 Fax: (314) 935-6145, e-mail: rhusar@me.wustl.edu

a. Professional Preparation

- 1962–66 Dipl. Ing. Mechanical Engineering, Technical University, Berlin, FRG.
1966-71 Ph.D. Mechanical Engineering, U. of Minnesota, Minneapolis, MN, US.
1971-73 Post-Doctoral Fellow, California Institute of Technology, Pasadena, CA, US.

b. Appointments

- 1979-Present Director, Center CAPITA, Washington University St. Louis, MO
1976-Present Professor, Mechanical Engineering, Washington U. St. Louis, MO
1976-77 Visiting Professor, Meteorological Institute, Stockholm U., Sweden
1973-76 Associate Professor, Mechanical Eng, Washington U. St. Louis, MO

c. List of publications

- Husar, R.B., Poirot R.L., DataFed and FASTNET: Tools for Agile Air Quality Analysis, Environmental Managers, Air & Waste Management Association, September 2005, 39-41, 2005.
- C. Blachard, R. Husar, R. Vet, T. Dann, G. Raga, P. Solomon, E. Vega, Spatial and Temporal Characterization of Particulate Matter, In: McMurray, P.H., M.F. Sheperd, J.S. Vickery, eds. Particulate Matter Science for Policy Makers. A NARSTO Assessment, Cambridge University Press, (2004).
- Husar, R.B., Intercontinental Transport of dust - a historical and recent observational evidence. In: Intercontinental Transport of Air Pollution, A. Stohl, Ed. The Handbook of Environmental Chemistry, 4G, Springer Verlag Berlin, Heidelberg, New York (2004).
- Heintzenberg, J., F. Raes, S.E. Schwartz, I. Ackermann, P. Artaxo, T.S. Bates, C. Benkovitz, K. Bigg, T. Bond, J.L. Brenguier, F.L. Eisele, J. Feichter, A.I. Flossmann, S. Fuzzi, H.F. Graf, J.M. Hales, H. Herrmann, T. Hoffmann, B. Huebert, R.B. Husar, R. Jaenicke, B. Kärcher, Y. Kaufman, G.S. Kent, M. Kulmala, C. Leck, C. Liousse, U. Lohmann, Tropospheric Aerosols. In: Brasseur, G.P., R.G. Prinn, A.A.P. Pszenny, eds. Atmospheric Chemistry in a Changing World, The IGBP Series, Springer, (2003).
- Falke, S.R., R.B. Husar and B.A. Schichtel, Fusion of SeaWiFS and TOMS Satellite Data with Surface Observations and Topographic Data During Extreme Aerosol Events, *J. Air Waste Manage. Assoc.*, 51, 1579-1586 (2001).
- Schichtel, B.A., R.B. Husar, S.R. Falke, and W.E. Wilson, Haze Trends over the United States, *Atmos. Environ.*, 35, 5205-5210 (2001).
- Husar, R.B., D. M. Tratt, B. A. Schichtel, S. R. Falke, F. Li D. Jaffe, S. Gassó, T. Gill, N. S. Laulainen, F. Lu, M.C. Reheis, Y. Chun, D. Westphal, B. N. Holben, C. Gueymard¹ I. McKendry, N. Kuring, G. C. Feldman, The Asian Dust Events of April 1998. (<http://capita.wustl.edu/Asia-FarEast/>) *J. Geophys. Res.*, 106(D16), 18317-18330 (2001).
- Husar R. B., J. D. Husar and L. Martin, Distribution of continental surface aerosol extinction based on visual range data, <http://capita.wustl.edu/CAPITA/CapitaReports/GlobVisIGAC/AEGlobVisHTM.htm> *Atmos. Environ.* 34, 5067-5078 (2000).
- Lefohn, A. S., J. D. Husar and R.B. Husar, Estimating historical anthropogenic global sulfur emission patterns for period 1850-1990 (1999).
http://capita.wustl.edu/CAPITA/CapitaReports/GlobSEmissions/GlobS1850_1990.htm *Atmos. Environ.* 33, 3435-2444 (1999).
- Husar R.B., J.M. Prospero and L.L. Stowe, Characterization of Tropospheric Aerosols over the Oceans with the NOAA Advanced Very High Resolution Radiometer Optical Thickness Operational Product, *J. Geophys. Res.* 102, D14, 16889-16909 (1997).

d. Synergistic Activities

Professionally, Husar works on the interface between atmospheric science and environmental informatics, switching between the two in ten-year cycles. In 2005, he is finishing a cycle of software development which resulted in the DataFed data sharing and analysis system. In conducting this work, he interacted synergistically with others interested in Earth Science informatics. As a lead of the NASA Data Systems Workgroup, Web services subgroup, he has coordinated the development of a Web services roadmap. Husar has promoted openness and inclusiveness in his activities as part of the International Global Atmospheric Chemistry (IGAC) program. For the past four years, Husar was teaching a course in Environmental Informatics with focus on information engineering, i.e. the flow, driving forces and resistances of information flow and processing. He encourages teamwork and the use of the web as a communication/data-sharing medium for the class. Husar has long experience in the effective use of graphics in data exploration, analysis and presentation. In 1987, he and his co-workers have designed the data exploration software Voyager that is being used by many atmospheric data analysts worldwide. He co-developed a new 3D rendering algorithm for clouds. The synthetic 3D globe images (using data from four different satellites) generated by the new method vividly illustrates the Earth as an interactive system of air, land and water. The 3D Globe images were used by the National Geographic, Scientific American, five book/journal covers, NASA posters and many other public outreach efforts (capita.wustl.edu/MTPEPoster/).

Member, Hungarian Academy of Sciences, 1998

Associate Editor, Atmospheric Systems, The Scientific World, 2001-present

Member of Editorial Board, Environmental Monitoring and Assessment, 2000-present

Web sites

NARSTO PM Assessment, Chapter 5, Spatial and temporal characterization over North America

(<http://capita.wustl.edu/Databases/UserDomains/PMFineAnalysisWB>)

International Global Atmospheric Chemistry Program, IGAC, Integration Synthesis Team,

(<http://capita.wustl.edu/Databases/UserDomains/AerosolIntegration/>) 1998-present

Ozone Transport Assess. Group, OTAG, Air Quality Analysis Workgroup.

(<http://capita.wustl.edu/OTAG/>), Member, 1996-97

EPA Particulate Matter Criteria Document Panel, Contributor, 1996

WMO Panel on Global Aerosol Data System, Chair, 1991

WMO Panel on Space Observations of Tropospheric Aerosols, Group Leader, 1990

Course Taught

Spring Semester: MAE 499 Sustainable Air Quality

Thesis advisor and Postgraduate sponsor: *Dr. S. R. Falke, U. S. Environmental Protection Agency, Office of Environmental Information, Washington, DC; Dr. B. A. Schichtel, NPS Air Resources Division, CIRA, Colorado State University, Ft. Collins, Dr. Fang Li, University of California, La Jolla, CA, Marin Bezic, MSc., Microsoft, Redmond, WA.*

15 additional Ph.D. and Masters Theses and 21 post-doctoral associates and science visitors since 1973.

CURRICULUM VITAE

Name: Mark J. Jakiela

Date of birth: 30 December 1960

Academic rank: Professor, full time

Degrees:

B.S. 1983, Mechanical Engineering, University of Michigan.

M.S. 1984, Mechanical Engineering, University of Michigan.

DSc. 1988, Mechanical Engineering, University of Michigan.

Service on this faculty: 10 years

Original appointment: August 1996, Associate Professor
Hunter Associate Professor of Mechanical Design

Promotions: Full Professor, 1999

Other related experiences:

Academic:

MIT, Associate Professor, July, 1994 – July, 1996

MIT, Assistant Professor, July, 1988 – June, 1994

Associate Director, MIT Computer-Aided Design Lab

Consulting:

Computer Tool and Die Systems, Inc.	January, 1988 – July, 1988
Nissan Research and Development Corporation	January, 1989 – September, 1989
General Motors Advanced Engineering Staff	December, 1990 – August, 1991
Center for Concept Development	October, 1992
The Gillette Company	October, 1992
Product Genesis, Inc.	February, 1993
Center for Concept Development	March, 1994
EMPower Corporation	January, 1996 – July 1996
Kennelwood Village	November, 1998 – Present

Principal publications:

Jakiela, M.J., with Chapman, C., Duda, J., Adewuya, A., Saitou, K., “Continuum Structural Topology Design with Genetic Algorithms,” *Invited submission* for a special issue on Evolutionary and Genetic Algorithms in Computational Mechanis and Engineering, Computer Methods in Applied Mechanics and Engineering, June, 2000.

Krishnasamy, J. Jakiela, M.J., “Resonance INduced Failure of Entrapment: Application to Industrial Parts Feeding,” International Journal of Robotics Research, Vol. 19, No. 5, Sage Publications Inc., Thousand Oaks California, May 2000.

Saitou, K., Jakiela, M.J., “On Classes of One-Dimensional Self-Assembling Automata,” Complex Systems, Vol. 10, No. 6, pp. 391-416, December, 1996.

Duda, J.W., Jakiela, M.J., “Generation and Classification of Structural Topologies with Genetic Algorithm Speciation,” (technical brief), ASME Journal of Mechanical Design, Vol. 119, No. 1, pp. 127-131, March, 1997.

Saitou, K., Jakiela, M.J., “Subassembly Generation via Mechanical Conformational Switches, » Artificial Life (The MIT Press), Vol. 2, pp. 377-416, 1995.

Saitou, K., Jakiela, M.J., “Automated Optimal Design of Mechanical Conformational Switches,” Artificial Life (The MIT Press), Vol. 2, No. 2, pp. 129-156, 1995.

Leeser, K., Jakiela, M.J., "Robotic Handling and Assembly of Flexible Printed Circuit Boards," *Manufacturing Review*, Vol. 8, No. 1, pp. 6-21, March 1995.

Wallace, D.R., Jakiela, M.J., Flowers, W.C., "Design Search Under Probabilist Specifications Using Genetic Algorithms," (invited submission), *Computer-Aided Design*, Vol. 28, No. 5, pp. 405-421, 1996.

Krishnasamy, J., Jakiela, M.J., "a Method to Resolve Ambiguities in Corner-Corner Interactions Between Convex Polygons in the Context of Motion Simulations Using a Penalty-Based Contact Model," *The International Journal for Computer-Aided Engineering and Software – Engineering Computations* (Pineridge Press), Vol. 12, No. 2, pp. 135-144, February, 1995.

Dighe, R., Jakiela, M.J., "Genetic Algorithm-Based Structural Topology Design with Compliance and Topology Simplification Considerations," *ASME Journal of Mechanical Design*, Vol. 118, No. 1, pp. 89-98, March, 1996.

Scientific and professional society membership:

American Society of Mechanical Engineers, Associate

Honors and awards:

Flowers Career Development Chair (MIT), September, 1989 – August, 1991

NSF Presidential Young Investigator, September, 1990 – August, 1995

Noyce Career Development Chair (MIT), September, 1992 – August, 1994

Hunter Professorship (Washington University), August, 1996

Professional registration: None

Courses taught during most recent academic year 2005-2006:

Fall semester:

MAE 141D "Introduction to Engineering Design: Project," 2 hours/week lecture.

Spring semester:

MAE 322A "Mechanical Design and Machine Elements," 4 hours/week lecture.

Other assigned duties: None

Participation in specific professional development programs, since 2001: None

Other duties: None

CURRICULUM VITAE

Name: Kenneth L. Jerina

Date of birth: 2 November 1946

Academic rank: Professor, full time

Degrees:

B.Sc., Theoretical and Applied Mechanics, University of Illinois, 1969

M.Sc., Mechanical Engineering, Washington University, 1971

D.Sc., Mechanical Engineering, Washington University, 1974

Service on this faculty: 24 years

Original appointment: January 1982, Associate Professor

Promotions: July 1988, Professor

Other related experience:

Academic:

Assistant Professor of Civil Engineering, Texas A&M University, College Station Texas, 1978-1982

Industrial :

Director of the Experimental Mechanics Research Laboratory, MTS Systems Corporation, Minneapolis, Minnesota, 1973-1978

Materials Research Engineer, Air Force Materials Laboratory, Wright-Patterson Air Force Base, Ohio, 1971-1973

Engineering Consultant, University of Dayton Research Institute, Dayton, Ohio, Summer 1969 and 1970

Consulting:

Sherwood Medical: Stress Analysis of Polymers

Bonutti Orthopaedic: Testing of Prosthesis

Robert Herman: Analysis of Man Lift Mechanism

Professional registration: Texas-48822

Principal publications:

Brandon HJ, Young VL, Jerina KL, Wolf CJ. "SEM Characterization of Surgical Instrument Damage to Breast Implants," *Plast Reconstr Surg.* Vol. 108, No. 1, July 2001.

Brandon HJ, Young VL, Jerina KL, Wolf CJ. "Variability in the Properties of Silicone Gel Breast Implants," *Plast Reconstr Surg* Vol. 108, No. 3, pp. 647-655, Sept. 2001.

Wolf CJ, Jerina KL, Brandon HJ, Young VL.. "The Transport of Octamethylcyclotetrasiloxane (D₄) and Polydimethylsiloxane (PDMS) in Lightly Cross-linked Silicone Rubber," *J. Biomater. Sci. Polymer Edn*, Vol. 12, No. 7, pp. 801-815, 2001.

Brandon HJ, Young VL, Jerina KL, Wolf CJ. "In Vivo Aging Characteristics of Silicone Gel Breast Implants Compared to Lot-Matched Controls," *Plast. and Reconstr. Surg.*, Vol. 109, No. 6, pp. 1927-1933, 2002.

Wolf CJ, Jerina KL, Brandon HJ, Young VL. "The Effect of Cyclic Swelling (Octamethylcyclotetrasiloxane) on the Physical Properties of Silicone Breast Implant Shells," *J. Biomater. Sci. Polymer Edn*, Vol. 13, No. 1, pp. 27-41, 2002.

Brandon HJ, Young VL, Wolf CJ, Jerina KL, Watson ME, McLaughlin JK. "Discussion of Silicone Gel Breast Implant Failure: Evaluation of Properties of Shells and Gels for Explanted Prostheses and Meta-Analysis of Literature Rupture Data," *Annals of Plastic Surgery*, Vol. 49, No. 3, pp. 16-21, 2002.

Brandon HJ, Young VL, Jerina KL, Wolf CJ, Adams WP, Watson ME. "Mechanical Analysis of Explanted Saline-filled Breast Implants Exposed to Betadine Pocket Irrigation," *Aesth Surg J*, Vol. 22, No. 5, pp. 438-445, 2002.

Brandon HJ, Jerina KL, Wolf CJ, Young VL. "Biodurability of Retrieved Silicone Gel Breast Implants," *Plast. and Reconstr. Surg.* Vol. 111, No. 7, June 2003.

Brandon HJ, Young VL, Watson ME, Jerina KL, Wolf CJ. "Protocol for Retrieval and Analysis of Breast Implants," *J Long-Term Effects of Med Implants* 13:49-61, 2003.

Brandon HJ, Young VL, Wolf CJ, Jerina KL, Watson ME, McLaughlin JK. "Letter of Reply to the Discussion of Silicone Gel Breast Implant Failure: Evaluation of Properties of Shells and Gels for Explanted Prostheses and Meta-Analysis of Literature Rupture Data," *Annals of Plastic Surgery*, Vol. 51, No. 3, pp. 334-336, 2003.
Brandon HJ, Jerina KL, Savoy TL, Wolf CJ. "Scanning Electron Microscope Fractography of Induced Fatigue-Damaged Saline Breast Implants," *J Long-Term Effects of Med Implants*, 16(1)73-84, 2006.

Scientific and professional society membership:

Society of Manufacturing Engineers, 1999-present
American Society for Testing and Materials, 1972-present
American Society of Mechanical Engineers, 1972-present
Sigma Xi, 1985-present

Honors and awards:

ASTM Award of Appreciation, 1999
Earl E. and Myrtle E. Walker Professorship in Engineering Inaugural Professor, 1998
Industrial College of the Armed Forces Award of Appreciation, 1997
Burlington Northern Foundation Award for Distinguished Achievement in Teaching, 1989
ASME Certificate of Appreciation, 1988, 1989, 1990, 1991 and 1992
Washington University School of Engineering Professor of the Year, 1984
Gordon Conference Lecturer on Composite Materials, 1980
US-USSR Cooperative Exchange Program on Fatigue, 1977
Special Achievement Award, Air Force Materials Laboratory, 1972

Courses taught during most recent academic year 2005-2006:

Fall semester:

MAE 5904 Aircraft Control & Simulation, 3 hours/week lecture, 1 section, day, graduate

Spring semester:

ME 204 Introduction to Manufacturing Processes, 2 hours/week lecture, 3 hours/week lab,
1 section, day, undergraduate
ME 433 Aircraft Flight Dynamics & Control, 3 hours/week lecture, 1 section, day,
undergrad/graduate

Other assigned duties:

Chairman, Materials Science and Engineering Program, 1991-present
Director, Center for Materials Research, 1991-present
Graduate Board, Chairman 1987-present, member 1982-present
Director of Mechanical Engineering Graduate Studies and Programs, 1997-present
Mechanical Engineering Laboratory Committee, 1983-present
Executive Committee, 1986-1987, 1991-2000
Merit Scholar Interviewer, 1982-1992
Advisory Committee Faculty Assembly, 1985-1987, 1991-1992
Director of the Center for Engineering Computing, 1986-1991
Doctoral Qualifying Examination Committee, 1983-present
Chancellors Committee on Retention, 1989-1991
Dean's Committee on Academic Mission, 1991-1992
Freshman Advisor, 1984-1992
ASME Student Section Faculty Advisor, 1987-1992
Principal Investigator on Sponsored Research

Participation in specific professional development programs, since 1989:

American Society for Testing and Materials
Chairman, 30th National Symposium on Fatigue and Fracture Mechanics
Advanced Materials E08.05.04, Task Group chairman, 1993 - present

Other duties: None

CURRICULUM VITAE

Name: D.C. Look

Date of birth: 25 August 1938

Academic rank: Adjunct Professor

Degrees:

A.B. 1960, Central College, Fayette, Missouri.

M.S. 1962, University of Nebraska, Lincoln, Nebraska.

Ph.D. 1969, University of Oklahoma.

Service on this faculty: 3 years

Original appointment: January 2004, Adjunct Professor

Other related experiences:

Academic:

Teaching Assistant, Physics Department, University of Nebraska, Lincoln, Nebraska, September 1960-May 1963

Evening College Instructor, Mathematics Department, Texas Christian University, Ft. Worth, Texas, January 1967-June 1967

Special Instructor, Aerospace and Mechanical Engineering Department, University of Oklahoma, Norman, Oklahoma, January 1969-June 1969

Assistant Professor, Mechanical and Aerospace Engineering, University of Missouri – Rolla, Rolla, Missouri, September 1973-August 1978

Professor, Mechanical and Aerospace Engineering, University of Missouri – Rolla, Rolla, Missouri, August 1978-present

Professor Emeritus, Mechanical and Aerospace Engineering, University of Missouri – Rolla, Rolla, Missouri, August 2000.

Industrial:

Aerosystems Engineer, Fort Worth Division of General Dynamics, Fort Worth, Texas, June 1963-September 1967.

Principal publications, 2001-2006:

Look, D.C., Jr., “1-D Fin Tip Boundary Condition Correction II”, *Heat Transfer Engineering*, Vol. 22, No. 5, pp. 35-40, Sept/Oct 2001.

Kang, H.S., and Look, D.C. Jr., “A Thermally Asymmetric Triangular Fin Analysis”, *Journal of Thermophysics and Heat Transfer*, Vol. 15, No. 4, pp. 427-430, Sept/Oct 2001.

Kang, H.S., and Look, D.C. Jr., “Analysis of a Three-Dimensional Thermally Asymmetric Parallelepiped (Applicable to Fins)”, *Journal of Thermophysics and Heat Transfer*, Vol. 16, No. 2, pp. 280-283, Apr/June 2002.

Kang, H.S., and Look, D.C. Jr., “Optimization of Thermally and Geometrically Asymmetric Trapezoidal Fins”, *Journal of Thermophysics and Heat Transfer*, accepted.

Prabhar, P., Look, D.C. Jr., and Balakrishnan, S.N., “Experimental Model Determination for Neuro Control of a Thermal Conduction System”, *Journal of Thermophysics and Heat Transfer*, accepted.

Honors and awards:

Pi Tau Sigma

Kappa Mu Epsilon (Honorary Mathematics Fraternity)

Sigma Xi Society

Omicron Delta Kappa (Honorary Leadership Society)

National Defense Education Act Fellow (Title IV, Univ. of Oklahoma, September 1967-August 1969)

Ralph R. Teetor Award (1978)

Tau Beta Pi – Eminent Engineer (April 2000)

Professional Affiliations: AIAA, ASEE, ASME, MAS, SPIE

Professional registration: None

Courses taught during most recent academic year 2005-2006:

Fall semester:

MAE 512, "General Thermodynamics," 3 hours/week lecture.

Spring semester:

MAE 530 "Conduction and Convection Heat Transfer," 3 hours/week lecture.

Other assigned duties: None

Participation in specific professional development programs, since 2001: None

Other duties: None

CURRICULUM VITAE

Name: Ruth J. Okamoto

Date of birth: 10 July 1963

Academic rank: Assistant Professor, full time

Degrees:

B.S., Mechanical Engineering, Massachusetts Institute of Technology, 1985

M.S., Mechanical Engineering, Massachusetts Institute of Technology, 1987

D.Sc., Mechanical Engineering, Washington University, 1997

Service on this faculty: 9 years

Original appointment: October 1997, Assistant Professor

Promotions: none

Other related experiences:

Academic:

Asst. Prof. of Mech. Eng., Wash. Univ., St. Louis, Missouri, 1997-present

Cardiovascular Engineering Program Faculty, Institute for Biological and Medical Engineering,

Washington University, St. Louis, MO, 1997-present

Asst. Prof. of Biomedical Eng., Wash. Univ., St. Louis, Missouri, 2000-present

Industrial:

Design Engineer, Digital Equipment Corporation, Shrewsbury, MA, 1987-1989

Engineering Software Specialist, Digital Equipment Corporation, St. Louis, MO, 1989-1993

Consulting: none

Professional registration: Missouri, Passed Fundamentals of Engineering Exam, April 1998

Principal publications, 2001-2006:

Okamoto, RJ. "Blood Vessel Mechanics," in Encyclopedia of Biomaterials and Biomedical Engineering, G. Wnek and G. Bowlin, Eds. New York: Marcel Dekker, (accepted)

Wagenseil JE, Okamoto RJ. Modeling Cell and Matrix Anisotropy in Fibroblast Populated Collagen Vessels. Biomechanics and Modeling in Mechanobiology (in press)

Wagenseil JE, Neurukar NL, Knutsen RH, Okamoto RJ, Li DY, Mecham RP. Effects of Elastin Haploinsufficiency on the Mechanical Behavior of Mouse Arteries. American Journal of Physiology – Heart and Circulatory Physiology 289:H1209-1217, 2005.

Wagenseil JE, Elson EL, Okamoto RJ. Cell Orientation Influences the Biaxial Mechanical Properties of Fibroblast Populated Collagen Vessels. Annals of Biomedical Engineering 32:720-731, 2004.

Bayly PV, Ji S, Song SK, Okamoto RJ, Massouros P, Genin GM. Measurement Of Strain In Physical Models Of Brain Injury: A Method Based On HARP Analysis Of Tagged Magnetic Resonance Images (MRI). ASME Journal of Biomechanical Engineering 126: 523-528, 2004.

Wagenseil JE, Wakatsuki T, Okamoto RJ, Zahalak GI, Elson EL. One-Dimensional Viscoelastic Behavior of Fibroblast Populated Collagen Matrices. ASME Journal of Biomechanical Engineering 125: 719-725, 2003.

Okamoto RJ, Xu H, Kouchoukos NT, Moon MR, Sundt TM. The Influence Of Mechanical Properties On Wall Stress And Distensibility Of The Dilated Ascending Aorta. Journal of Thoracic and Cardiovascular Surgery 126:842-850, 2003.

Okamoto RJ, Wagenseil JE, DeLong WD, Peterson SJ, Kouchoukos NT, Sundt TM. Mechanical Properties of Human Aorta. Annals of Biomedical Engineering 30: 624-635, 2002

Scientific and professional society membership:

American Society of Mechanical Engineers, Associate Member
Biomedical Engineering Society, Associate Member

Honors and awards:

Clapp and Poliak Undergraduate Design Engineering Award, 1984
American Society of Mechanical Engineers Graduate Teaching Fellowship, 1995-1996
Student Union Professor of the Year (Engineering), Washington University, 1999

Courses taught during most recent academic year 2005-2006:**Fall semester:**

MAE 404P "Mechanical Engineering Design Projects," 5 hours/week lecture/lab day undergraduate
(course coordinator and instructor)

Spring semester:

BME 567 "Cardiac Mechanics," 3 hours/week lecturer, day graduate

Other assigned duties:

Member, Dept. of Mechanical Engineering Computational Mechanics Faculty Search Committee (20 hrs)
Undergraduate Advisor, 12 students

Participation in specific professional development programs, since 2001: None**Other duties:**

Faculty Advisor, Student Section, American Society of Mechanical Engineers, 2003-present
Co-PI on NSF GK-12 grant, "Partnerships for Math, Science and Engineering Instruction through Computer Visualization." Work with graduate students to develop introductory engineering design curriculum for 6th grade public school students.
Developer, coordinator and presenter for "Moving and Shaking - An Introduction to Engineering", six week workshop for middle schoolers at Washington University, sponsored by the St. Louis Gifted Resource Council, presented annually in Oct-Nov since 2001
Workshop leader for Society of Women Engineer's "Women in Engineering Day", held annually at Washington University. 2001-2004, 2006.

Thesis advisor to:

Wei Du (D.Sc. candidate, Mechanical Engineering), 2005-present
Jeremiah Wille (D.Sc. candidate, Biomedical Engineering), 2003-present
Kelly Brinkley (M.S. Mechanical Engineering), 2004-2006
Chris Pozzo (M.S. Mechanical Engineering), 2002-2004
Jessica Wagenseil (D.Sc, Biomedical Engineering), 1999-2003
Ajay Bohra (M.S., Mechanical Engineering) 2000-2002.

CURRICULUM VITAE

Name: Paul C. Paris

Date of birth: 7 August 1930

Academic rank: Professor, full time

Degrees:

B.S., Engineering Mechanics, University of Michigan, 1953

M.S., Applied Mechanics, Lehigh University, 1955

Ph.D., Applied Mechanics, Lehigh University, 1962

Service on this faculty: 18 years

Original appointment: September 1976, Professor

Promotions: None

Other related experiences:

Academic:

Visiting Professor, Brown University, 1974-1976

Professor of Mechanics, Lehigh University, 1963-1972

Associate Professor of Mechanics, Lehigh University, 1963-1965 (on leave 1964-1965)

Assistant Professor of Mechanics, Lehigh University, 1962-1963

Program Director, National Science Foundation, 1964-1965

Assistant Director, Lehigh University, 1962-1964

Assistant Professor, University of Washington 1957-1962 (on leave 1960-62)

Instructor, Lehigh University, 1955-1957

Instructor, Lafayette College, 1954-1955

Research and Teaching Assistant, Lehigh University, 1953-1954

Industrial:

Advisory Director, St. Louis Screw & Bolt Inc., 1992-present

Director and Consultant, Fracture Proof Design Corporation 1979-1985

Director, T.T.I. Corporation 1978 to present

Chairman and President, Del Research Corporation 1967 to present

Faculty Summer Program, The Boeing Company, summers 1955, 1956, 1967

Research Engineer and Consultant, The Boeing Company 1958-1962

Consulting:

Has consulted with numerous industrial firms and government agencies (more than 50)

Professional registration:

None

Scientific and professional society membership:

U.S. National Committee on Theoretical and Applied Mechanics

Sigma Xi

American Society for Testing and Materials

Honors and awards:

Swedlow Memorial Lecturer, ASTM, 1992
International Fatigue Senses, 1990, Honorary Fellow and life member
International Congress on Fracture, 1989, Honorary Fellow
ASTM, 1987, Fracture mechanics medal
Stanley P. Rockwell Memorial Lecturer, ASM and AIME, 1976
Award of Merit – ASTM, 1972

Courses taught during most recent academic year 2005-2006:

Spring semester:

ME 502 "Advanced Analytical Mechanics," 3 hours/week lecture, 1 section, day, graduate

Other assigned duties:

None

Participation in specific professional development programs, since 2001:

None

Other duties:

None

CURRICULUM VITAE

Name: David A. Peters

Date of birth: 31 January 1947

Academic rank: Professor, full time

Degrees:

B.S., Applied Mechanics, Washington University, 1969

M.S., Applied Mechanics, Washington University, 1970

Ph.D., Aeronautics and Astronautics, Stanford University, 1974

Service on this faculty: 20 years

Original appointment: April 1975, Assistant Professor

Promotions: Associate Professor, 1977

Full Professor, 1980

Department Chairman, 1982-1985, 1997-present

McDonnell Douglas Prof. of Engineering, 1999-present

Other related experiences:

Academic:

Professor of Aerospace Engineering, Georgia Inst. of Technology, Atlanta, GA, 1985-1991

Director of Georgia Tech NASA Space Grant Consortium, 1989-1991

Adjunct Professor, 1991-present

Director of Washington University Center for computational Mechanics, 1992-present

Assistant. Director of Georgia Tech/Washington University Center of Excellence for Rotary-Wing Dynamics, 1992 -present

Industrial:

Associate Eng., McDonnell Douglas Astronautics Co., St. Louis, Missouri, 1969-1970)

Research Scientist, Army Air Mobility R&D Lab., Ames Research Center, Moffett Field, CA, 1970-75

Consulting:

Rotor blade dynamics, Mark Tannenbaum, Charleston, S. C. (1994)

Rotor-to-rotor interference, ATCOM, St. Louis (1994)

CH-47 Blade Design, Boeing Helicopters, Philadelphia, PA (1994)

Structural dynamics, M & M/Mars, Albany, Georgia (1995-1996)

Analysis of Spin-Wing Aircraft, Thorpe See-Op Corp., St. Louis (1995-1997)

Motor vibrations, Emerson Electric, St. Louis (1996)

Panel vibrations, Nordine, St. Louis (1996)

Vibration of cans, Anheuser Busch, St. Louis (1996-1997)

Random Vibrations, Response Mechanics, St. Louis (1997)

Vibration Measurement, Union Electric, St. Louis (1997)

Helicopter/Sling-Load Dynamics, Bell Helicopter (1997-1998)

Apache Flight Simulation, Boeing, St. Louis (1997-1999)

Tool Vibrations, Ingersoll-Rand, Ohio 1999

Professional registration:

Missouri, E-18351

Georgia, 15382

Principal publications, 2001-2006

- Hodges, Dewey H., and Peters, David A., "Lateral-Torsional Buckling of Cantilevered Elastically Coupled Composite Strip- and I-Beams," *International Journal of Solids and Structures*, Vol. 38, No. 9, 2001, pp. 1585-1603.
- Krothapalli, K.R., Prasad, J.V.R., Peters, D.A., "Helicopter Rotor Dynamic Inflow Modeling for Maneuvering Flight," *Journal of the American Helicopter Society*, Vol. 46, No. 2, April 2001, pp. 129-139.
- Morillo, Jorge and Peters, David. "Velocity Field Above a Rotor Disk by a New Dynamic Inflow Model," *Journal of Aircraft*, Vol. 39, No. 5, Sept. – Oct. 2002, pp. 731-738.
- Peters, David A., Morillo, Jorge, and Nelson, Adria M., "New Developments in Dynamic Wake Modeling for Dynamics Applications," *Journal of the American Helicopter Society*, Vol. 48, No. 2, April 2003, pp. 120-127.
- Zhao, J., Prasad, J.V.R., Peters, D.A., "Rotor Wake Distortion Model for Helicopter Maneuvering Flight," *Journal of the American Helicopter Society*, Vol. 49, No. 4, Oct. 2004, pp. 414-424.
- Yu, Ke and Peters, D.A., "State-Space Inflow Modeling for Lifting Rotors with Mass Injection," *The Aeronautical Journal*, Vol. 108, No. 1085, July 2004, pp. 333-344.
- Yu, Ke and Peters, David A., "Nonlinear Three-Dimensional State-Space Modeling of Ground Effect with a Dynamic Flow Field," *Journal of the American Helicopter Society*, Vol. 50, No. 3, July 2005, pp 259-268.

Scientific and professional society membership:

- American Society of Mechanical Engineers, Fellow
American Institute of Aeronautics and Astronautics, Fellow
American Helicopter Society, Member
American Academy of Mechanics, Member
American Society for Engineering Education, Member
International Association for Computational Mechanics, Charter Member
International Society for Structural and Multidisciplinary Optimization, Member
American Helicopter Museum and Education Center, Charter Member

Honors and awards:

- Member Tau Beta Pi, Pi Tau Sigma, Sigma Xi
NASA Scientific Contribution Award, 1975
NASA Technology Utilization Award, 1976
ASME Pi Tau Sigma Gold Medal, 1978
School of Engineering Professor of the Year, Washington University, 1980
Missouri Society of Professional Engineers, Outstanding Engineering Educator, 1984
Georgia Tech "Faculty Leadership for the Development of Graduate Research Assistants Award", 1991
AIAA St. Louis Section Technical Contribution Award, 1995
McDonnell Douglas Professorship in Engineering, 1999
Who's Who in America, Engineering, Science and Engineering, International Engineering, the Midwest, Technology Today, Jane's Aviation and Aerospace, American Education, and Frontiers of Science and Technology

Courses taught during most recent academic year 2005-2006:**Spring semester:**

- | | |
|---------|---|
| MAE 505 | "Analysis of Rotary-Wing Systems," 3 hours/week lecture, day graduate/senior elective |
| MAE 522 | "Theory of Vibrations," 3 hours/week lecture, day graduate/senior elective |

Other assigned duties: Director, Center for Computational Mechanics (6 hours/week)

Participation in specific professional development programs, since 2001: None

Other duties: None

CURRICULUM VITAE

Name: Dale M. Pitt

Date of birth: 21 September 1950

Academic rank: Adjunct Professor & Boeing Technical Fellow

Degrees:

B.S., Aerospace Engineering, University of Missouri – Rolla, 1972

M.S., Aerospace Engineering, University of Missouri – Rolla, 1975

D.Sc., Mechanical Engineering, Washington University, 1980

Service on this faculty: 10 years

Original appointment: January 1996, Adjunct Professor

Promotions: None

Other related experiences:

Academic:

Adjunct Professor of Mechanical Engineering – Forest Park Community College, 1980-1989

Industrial:

Aerospace Eng., United State Army Aviation Systems Command, St. Louis, Missouri, 1972-1981

Research Eng., McDonnell Aircraft Company now Boeing, St. Louis, Missouri, 1981-Present

Consulting:

Heating and Air Condition, St. Charles Heating & Cooling Company, 1993

Aerodynamics of wind on signs, Peter Galister Patent Attorney, 1993

Professional registration: Missouri, License No. 016745

Principal publications, 2002-2006

Kiiskila, J.C., Duncan, M.R. **Pitt, D. M.**, “Investigation of the Dynamic Characterization of Aircraft Control Surface Free Play”, IMAC Paper#179, Session #2, Presented at the 24th International Modal Analysis Conference, St. Louis, MO, Jan 30-Feb 2, 2006, St. Louis, MO.

Pitt, D. M., Haudrich, D.P., “A Technique for Determining the Critical Flutter Configuration from Multiple External Stores Utilizing Artificial Neural Networks”, IF-092, Presented at the Forum on Aeroelasticity and Structural Dynamics 2005, IFASD 2005, June 28- July 1, 2005, Munich, Germany.

Liguore, S., **Pitt, D. M.**, “New Research on the Method of Predicting Wing Buffet”, IF-031, Presented at the Forum on Aeroelasticity and Structural Dynamics 2005, IFASD 2005, June 28- July 1, 2005, Munich, Germany.

Moses, R.W, Pototzky, A.S., Henderson, D.A, Galea, S.C, Manokaran, D.S, Zimcik, D.G., Wickramasinghe, **Pitt, D.M.**, Gamble, M.A., “Actively Controlling Buffet-Induced Excitations”, RTO-MP-AVT-123 Symposium Paper #19, Presented at “Flow-Induced Unsteady Loads and the Impact on Military Applications” Symposium, Budapest, Hungary, 25-28 April 2005.

Pitt, D. M., Burnham, J.K., Henderson, D.A., Moses, R.W., “Design and Modeling of an Advance Buffet Load Alleviation System for a Fighter Aircraft Vertical Tail”, RTO-MP-AVT-123 Symposium Paper #23, Presented at “Flow-Induced Unsteady Loads and the Impact on Military Applications” Symposium, Budapest, Hungary, 25-28 April 2005.

Pitt, D. M., Haudrich, D.P., “Development of an Artificial Neural Aeroelastic Network (AN²) for the Prediction of Multiple Flutter Crossings“, AIAA 2005-2288, Presented at 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 18-21 April 2004, Austin, TX.

Liguore, S., **Pitt, D. M.**, “Aircraft Buffet Prediction Using Unsteady Aerodynamics Wind Tunnel Model Six-Component Balance Data“, AIAA 2004-2045, Presented at 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 April 2004, Palm Springs, CA..

Pitt, D. M., “Static and Dynamic Aeroelastic Analysis of Structural Wing Fold Hinges That are Employed as an Aeroelastic Tailoring Tool“, AIAA 2004-1754, Presented at 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 April 2004, Palm Springs, CA..

- Pitt, D. M.**, Haudrich, D.P., “Artificial Neural Network for Multiple Aeroelastic Analysis“, AIAA 2004-1750, Presented at 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 April 2004, Palm Springs, CA..
- Hu, Z., Jakiela, M., **Pitt, D.M.**, Burnham, J., “Reducing Aerodynamic Vibration with Piezoelectric Actuators – A Genetic Algorithm Optimization”, Presented at 11th Annual International Symposium on Smart Structures and Materials Conference, 14-17 March 2004, San Diego, CA.
- Pitt, D. M.**, Hayes, W. B., Goodman, C. E., “F/A-18E/F Aeroservoelastic Design, Analysis, and Test”, AIAA-2003-1880, Presented at 44th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 7-10 April 2003, Norfolk, VA.
- Pitt, D.M.**, Dunne, J.P., White, E.V., “Design and Test of a SMA Powered Adaptive Aircraft Inlet Internal Wall”, AIAA-2002-1356, Presented at 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 22-25 April 2002, Denver, CO.
- Pitt, D.M.**, Dunne, J.P., White, E.V., “SAMPSON Smart Inlet Design Overview and Wind Tunnel Test Part I – Design Overview”, SPIE 4698-02, Presented at 9th Annual International Symposium on Smart Structures and Materials Conference, 17-21 March 2002, San Diego, CA.
- Pitt, D.M.**, Dunne, J.P., White, E.V., “SAMPSON Smart Inlet Design Overview and Wind Tunnel Test Part II – Wind Tunnel Test”, SPIE 4698-03, Presented at 9th Annual International Symposium on Smart Structures and Materials Conference, 17-21 March 2002, San Diego, CA.

Scientific and professional society membership:

American Society of Mechanical Engineers
 American Institute of Aeronautics and Astronautics, Associate Fellow
 Member of Structural Dynamics Technical Committee
 2006 Chairman and 2005 Vice-Chairman of St. Louis Section
 General Chairman of 2007 National Dynamics Specialist Conference
 Technical Chairman of 2003 National Dynamics Specialist Conference
 American Helicopter Society, Member
 Society of Experimental Mechanics, Member

Honors and awards:

Awarded two (2) United States Patents
 Four (4) patent applications under consideration by the United States Patent Office
 Best Technical Presentation at 10th Boeing Technical Exchange, Oct 2005
 Selected a “**Boeing Technical Fellow**”, January 2003.
 Elected to University of Missouri - Rolla Academy of Mech & Aero Engrs, 2003
 Member Intercollegiate Knights, Tau Beta Pi, Phi Kappa Phi, Sigma Xi, Sigma Gamma Tau
 St. Louis Section of American Helicopter Society (AHS) – Best Technical Presentation, 1976
 St. Louis Section of American Institute of Aeronautics and Astronautics – Outstanding Young Engineer, 1979
 Listed in Jane's Who's Who in Aviation and Aerospace 1983
 Winner of 1977 - 1979 AHS Vertical Flight Foundation Scholarship for Continuing Education
 Three Suggestion Awards (U.S. Army Aviation Systems Command)
 Two Cost Reduction Awards (U.S. Army Aviation Systems Command)
 Special Act Award (U.S. Army Aviation Systems Command)
 Letter of Commendation (U.S. Army Aviation Systems Command)
 "Engineer of the Week" (McDonnell Aircraft Company), May 1982
 McDonnell Douglas Aerospace Quality Achievement Award, July 1997

Courses taught during most recent academic year 2005-2006:

Summer semester:

JME 4170 & JME4180: "Dynamic Response of Linear Systems", 2 hrs/wk lecture, 2 hours lab, evening, undergraduate

Other assigned duties: None

Participation in specific professional development programs, since 1995: None

Other duties: None

CURRICULUM VITAE

Name: Shankara M. L. Sastry

Date of birth: 11 June 1946

Academic rank: Professor, full time

Degrees: B.S. Physics and Mathematics, Bangalore University, India, 1965
B.Eng. Metallurgy, Indian Institute of Science, 1968
M.Eng. Physical Metallurgy, Indian Institute of Science, 1970
Ph.D. Metallurgy and Materials Science, University of Toronto, 1974

Service on this faculty: 20 years

Original appointment: Affiliate Professor, 1986

Promotions: Professor, 1991

Other related experience:

Academic:

St. Clair Junior College, Dayton, OH (75-6) part time instructor
Florissant Valley CC, St. Louis, MO, (79-83) part time instructor

Industrial:

Visiting Scientist, Air Force Materials Laboratory, Wright-Patterson AFB, 1974-7
McDonnell-Douglas Research Laboratories, St. Louis, MO, 1977-91

Consulting:

High Performance Materials, Inc., (91-94), Ogden/ERC (91-92), Laclede Gas Company (92-93), NUTHERM (92-93), American Family Insurance Co. (93-94) MATSYS (95-96), St. Louis Bolt Company (95-96), USCI (92-93), CARR, KOREIN, TILLERY, KUNIN, MONTROY & GLASS (96-97), BJC Health Systems (96-97)

Professional Registration: None

Principal publications, 1996-2000:

"A Flame Process for Synthesis of Unagglomerated, Low-Oxygen Nanoparticles: Application to Ti and TiB₂": R.L. Axelbaum, D.P. DuFaux, C.A. Frey, and S.M.L. Sastry, *Metallurgical and Materials Transactions B* 28B:1199-1211 (1997).

"Nanophase Tungsten and Tungsten-Titanium Composites via Gas-phase combustion synthesis": R.L. Axelbaum, J.I. Huertas, C.R. Lottes, S. Hariprasad, S.M.L. Sastry: *Materials and Manufacturing Processes*, Dec. 96, 1043-1053

"Gas-phase Combustion Synthesis of Titanium Boride [TiB₂] Nanocrystallites": R.L. Axelbaum, D.P. DuFaux, C.A. Frey, K.F. Kelton, S.A. Lawton, L.J. Rosen, and S.M.L. Sastry, *Journal of Materials Research*, 1996 11, (4), pp 948-954

"Mechanical Properties of Nanocrystalline Copper Produced from Solution Synthesized Nanoparticles": R. Suryanarayanan, C.A. Frey, S.M.L. Sastry, B.E. Waller, S.E. Bates, and W.E. Buhro, *J. Mater. Res.*, 1996, 11 [2], p 439.

"Deformation, Recovery, and Recrystallization Behavior of Nanocrystalline Copper Produced by Solution Phase Synthesis": R. Suryanarayanan, C.A. Frey, S.M.L. Sastry, B.E. Waller, and W.E. Buhro, *J. Mater. Res.*, 1996, 11 [2], p 449.

"Undercooling and Supersaturation of alloying elements in rapidly solidified Al-8.5%Fe-1.2%V-1.7%Si alloys": S.Hariprasad, S.M.L.Sastry and K.L.Jerina *Journal of Materials Science*, 1996, 31, pp. 921-925

" Deformation behavior of Rapidly Solidified fine grained Al-8.5%Fe-1.2%V-1.7%Si alloys " : S.Hariprasad, S.M.L.Sastry and K.L.Jerina: *Acta Metallurgica* vol.44, 1996

"Creep-Fatigue Interactions in Eutectic Tin-Led Solder Alloys," C. G. Kuo, S. M. L. Sastry, and K. L. Jerina, *ASTM STP Fatigue of Electronic Materials*, 1996

Scientific and professional society memberships:

Past Vice Chairman and Chairman, Mechanical Metallurgy Committee of TMS AIME

Honors and Awards:

Distinguished ASEE Faculty Fellow, NRL, Washington D.C., 1997, Invited Speaker, Symposium on Mechanical Behaviour of Bulk Nanocrystalline Material, ASM/TMS Conference, Indianapolis, IN., 1997, McDonnell Douglas Fellow 1991, Invited Speaker, Hypersonics Symposium, Munich, West Germany, 1989, Invited Speaker, DARPA-Materials Research Council Meeting, La Jolla, CA 1984-1985, National Research Council Fellow, 1974-76

Courses taught during most recent academic year 2005-2006:

Summer 05: JME 3250- Materials Science, 3 hrs/week lecture, 1 section, undergraduate

Fall 05: MAE 325 Materials Science, 3 hrs/week lecture, 1 section, undergraduate
MAE 657 Materials Characterization Techniques I, 3 hrs/wk lecture, 1 section, evening, graduate

Spring 06: MAE 361A -Materials Engineering, 1 section, undergraduate
MAE 655 Nonmetallics, 1 section, evening, graduate

Other assigned duties: Undergraduate Student Advisor, Undergraduate Laboratory Committee, Materials Science, Qualifying Exam Committee

Participation in specific professional development programs, since 1989: None

Other duties:

Research thesis advisor for master's and doctoral candidates, Principal investigator, NSF NASA, AFOSR and Army contracts, Editorial Board of *Research Mechanica*

CURRICULUM VITAE

Name: Amy Q. Shen

Date of birth: 6 May 1973

Academic rank: Assistant Professor, full time

Degrees:

B.S., Engineering Mechanics, Hunan University, 1992

M.S., Civil and Environmental Engineering, University of Illinois in Urbana-Champaign, 1996

Ph.D., Theoretical and Applied Mechanics, University of Illinois in Urbana-Champaign, 2000

Service on this faculty: 3 years

Original appointment: September 2002, Assistant Professor

Consulting:

Procter and Gamble, O.H. (2004--present)

Principal publications

W. Alexandra, C. Lee, S. Roland & A. Q. Shen, Vortical interfaces of immiscible fluids, *Physics of Fluids*, 16, Sep. 2004, S12. (Cited by ScienceDaily,, Editor's Note, March 9, 2004)

J. Dolbow, E. Fried & A. Shen, Point defects in nematic gels: The case for hedgehogs, *Archive of Rational Mechanics and Analysis*, accepted.

Shen, B. Hamlington, W. Pickard, M. Knoblauch & W. Peters, Forisome based biomimetic smart materials, *Smart Materials and Structures*, submitted.

Steinhaus, P. Spicer & A. Shen, Surface properties on emulsion droplet formation, *Physical Review Letters*, submitted.

W. Pickard, M. Knoblauch, W. Peters & A. Q. Shen. Prospective energy densities in the forisome, a new smart material, *Materials Science and Engineering: C*, to appear, 2005.

A. Q. Shen, B. Gleason, G.H. McKinley & H. A. Stone, Fiber coating with surfactant solutions, *Physics of Fluids*, 14 (2002), 4055--4068

L. Shmuylovich, A. Q. Shen & H. A. Stone, Surface morphology of drying latex film multiple ring formation *Langmuir*, 18 (2002), 3441--3445.

A. Q. Shen, Granular wave patterns in a horizontal rotating cylinder, *Physics of Fluids*, 14 (2002), 462--470.

A. Q. Shen, Granular wave patterns and aeolian ripple formations, *Proceedings of the Royal Society of London A*., 458 (2003) 891--903

Scientific and professional society membership:

American Society of Mechanical Engineers

American Institute of Chemical Engineers

American Physical Society

The Society of Rheology

The Honor Society of {\it Phi Kappa Phi}

Honors and awards:

Ralph E. Powe Junior Faculty Enhancement Award, 2003.

Video award of Gallery of fluid motion, American physical society, Division of fluid dynamics, 2003.

Video award of Gallery of fluid motion, American physical society, Division of fluid dynamics, 2001.

Poster award of Gallery of fluid motion, American physical society, Division of fluid dynamics, 2001.

Elected member of Honor Societies of Phi Kappa Phi and Pi Tau Sigma, 1999.

Who's Who in America, Engineering, Science and Engineering, International Engineering, 2002

Who's Who in America's Teachers, 2005.

Courses taught during most recent academic year 2004-2005:**Fall semester:**

ME320A "Engineering Thermodynamics," 3 hrs/wk lecture, day, undergraduate

ME400 "Mechanical Engineering Seminar", 1 hr/wk, organizer

Spring semester:

ME652A "Rheology of Complex Fluids," 3 hours/week lecture, day graduate/senior elective

ME400 "Mechanical Engineering Seminar", 1 hr/wk, organizer

CURRICULUM VITAE

Name: Karl A. Spuhl

Date of birth: 5 June 1937

Academic rank: Adjunct Professor, part time

Degrees:

B.S., Electrical Engineering, Washington University, 1959

M.S., Electrical Engineering, St. Louis University 1970

Service on this faculty: 22 years

Original appointment: September 1984

Promotions: N/A

Other related experiences:

Industrial:

Emerson Electric Company, St. Louis Mo. June 1959 – March 1962. Engineering representative on Materials Review Board

The Boeing Company, St. Louis Mo. March 1962 to present. Engineer Scientist involved in research and development of sensor simulation technology. Previous experience includes the design and development of control systems, electronic systems, optical, and pneumatic systems supporting fighter aircraft and NASA space programs.

Consulting:

N/A

Professional registration:

Missouri, E-12099

Principal publications:

Spuhl, Karl A. Daniel A. Schmidt, "Experiments and Problem Issues in Simulating Real-time Person-in-loop air-to-ground Radar Imagery," *American Institute of Aeronautics and Astronautics*,

Scientific and professional society membership:

IMAGE Society, Chairman Special Interest Group on Sensors

American Institute of Aeronautics and Astronautics

The Institute of Electrical and Electronics Engineers

Honors and awards:

Associate Technical Fellow – The Boeing Company

Awarded Washington University's 1994 Excellence in Teaching Award.

Awarded honorary membership in Washington University's Chapter of Alpha Sigma Lambda

Courses taught during most recent academic year 2005-2006:

Fall semester:

JME 4331 "Control Systems I" 3 hrs/wk lecture, evening, undergraduate

Other duties: None

CURRICULUM VITAE

Name: Michael Alden Swartwout

Date of birth: 7 November 1970

Academic rank: Assistant Professor, full time

Degrees:

Bachelor of Science, Aeronautical & Astronautical Engineering, *University of Illinois (1991)*

Master of Science, Aeronautical & Astronautical Engineering, *University of Illinois (1992)*

PhD, Aeronautics & Astronautics, in the Space Systems Development Laboratory, *Stanford University (1999)*

Service on this faculty: 7 year

Original appointment: September 1999, Affiliate Professor

Promotions: September 2000, Assistant Professor

Other related experiences:

Academic:

Saint Louis University (1999-2000)

Adjunct professor in the Department of Aerospace & Mechanical Engineering:

AE-P440 – Astrodynamics (Fall 1999)

AE-P441 – Orbital Mechanics (Spring 2000)

Advisor for two Masters theses in spacecraft design and rocketry

Industrial:

Caelum Research (1996)

Intern for NASA Ames contract in the Computational Sciences Division. Research focus was on developing the capabilities of an automated mission planning and control architecture.

Gravity Probe B (1995)

Research assistant in systems engineering for NASA sponsored satellite-based physics experiment. Research focus was developing a simulation to analyze the in-orbit performance of the electrostatic suspension.

Professional registration:

Principal publications, 2001-2006

Swartwout, Michael, "Earth escape using a slowly rotating, doubly reflective solar sail," *Journal of Guidance, Control, and Dynamics*, 28(2):374-377, March/April 2005.

Swartwout, Michael, Christopher A. Kitts and James W. Cutler, "Sapphire: A Case Study in Student-Built Satellites" accepted for publication in the *Journal of Spacecraft and Rockets*, 2006.

Swartwout, Michael, Christopher Kitts, Pascal Stang and E. Glenn Lightsey, "A Standardized, Distributed Computing Architecture: Results from Three Universities", *Proceedings of the 18th Annual AIAA/USU Conference on Small Satellites*, SSC05-VI-6, Logan, UT, 8-11 August 2005.

Swartwout, Michael, "Deployable Inspector Spacecraft: Technology Development and Future Applications with Solar Sails," poster session at the 2004 Technology Applications Conference, Greenbelt, MD, 28-29 September 2004.

Swartwout, Michael, "University-Class Satellites: From Marginal Utility to 'Disruptive' Research Platforms," *Proceedings of the 18th Annual AIAA/USU Conference on Small Satellites*, SSC04-II-5, Logan, UT, 9-12 August 2004.

Swartwout, Michael , "Earth Escape Using a Slowly-Rotating, Doubly-Reflective Solar Sail," Proceedings of the 2004 AAS/AIAA Space Flight Mechanics Conference, AAS-04-280, Maui, Hawaii, 8-12 February 2004. [peer reviewed conference]

Neubauer, Jeremy and Michael Swartwout, "A Comparison of Solar Sail Control Methods in Geosynchronous Transfer Orbits," Proceedings of the 2004 AAS/AIAA Space Flight Mechanics Conference, AAS-04-281, Maui, Hawaii, 8-12 February 2004. [peer-reviewed conference]

Swartwout, Michael, "A Systematic Formulation of Spacecraft Health Management Decisions," IEEE Aerospace Applications Conference Proceedings 2001, IEEE Computer Society, Los Alamitos, CA, 2001. [peer-reviewed conference]

Swartwout, Michael and Keith J. Bennett, "Project Aria: Space Systems Research, Education and Public Outreach at Washington University," IEEE Aerospace Applications Conference Proceedings 2001, IEEE Computer Society, Los Alamitos, CA, 2001. [peer-reviewed conference]

Swartwout, Michael, "Theory and Implementation of Summarization: Improving Sensor Interpretation for Spacecraft Operations," PhD dissertation, Stanford University, December 1999.

Swartwout, Michael, "Engineering Data Summaries for Space Missions," *IEEE Aerospace Applications Conference Proceedings 1998*, IEEE Computer Society, Los Alamitos, CA, 1998.

Swartwout, Michael A., Christopher A. Kitts and Rajesh K. Batra, "Persistence-Based Production Rules for On-Board Satellite Autonomy," *IEEE Aerospace Applications Conference Proceedings 1999*, IEEE Computer Society, Los Alamitos, CA, 1999.

Niederstrasser, Carlos G., Michael A. Swartwout, and Christopher A. Kitts, "Design and Performance Testing of a Satellite Health Beacon Receiving Station," *IEEE Aerospace Applications Conference Proceedings 1999*, IEEE Computer Society, Los Alamitos, CA, 1999.

Scientific and professional society membership:

American Institute of Aeronautics and Astronautics (1989)

Institute of Electrical and Electronics Engineers (1998)

American Society for Engineering Education (2005)

Honors and awards:

National Science Foundation Graduate Fellowship in Engineering (1991-1995), Phi Kappa Phi, Tau Beta Pi.

Courses taught during most recent academic year 2005-2006:

Fall semester:

MAE 404P-AE – Mechanical Engineering Design Projects, 3 hrs/wk lecture, undergraduate

Spring semester:

MAE 190 –

MAE 201 – [Introduction to Aerospace Systems](#), 3 hrs/wk lecture, undergraduate

MAE 301 – [Spacecraft](#) Design, 3 hrs/wk lecture, undergraduate

Other assigned duties:

Faculty advisor for Washington University student chapter of AIAA and sponsor of undergraduate design contest entry.

Participation in specific professional development programs, since 2001:

None

Other duties:

None

CURRICULUM VITAE

Name: Barna A. Szabo

Date of birth: 21 September 1935

Academic rank: Professor, full time

Degrees:

B.S., University of Toronto, 1960

M.S., State University of New York at Buffalo, 1966

Ph.D., State University of New York at Buffalo, 1966

Service on this faculty: 32 years

Original appointment: September 1968, Assistant Professor

Promotions: Associate Professor, 1969

Full Professor, 1975

Other related experiences:

Academic:

State University of New York at Buffalo, New York (Instructor of Engineering and Applied Science),
1966-1968

Industrial:

The International Nickel Company of Canada Limited, Thompson, Manitoba Canada (mining engineer),
1960-1962

Acres Limited, Niagara Falls, Canada (1962; engineer, applied mechanics; 1966 consulting engineer),
1962-1966

Consulting:

Consultant, Association of American Railroads, 1974-1977

Consultant, Noetic Technologies Corp., St. Louis, 1984-1989

Consultant, The MacNeal-Schwendler Corporation, 1989-1992

Member of the Editorial Board, The International Journal of Software for Engineering Workstations, 1987-present,

SIAM Monographs in Science and Engineering 1994

Professional registration:

Missouri, E-15029

Principal publications, 2001-2006

“Extracting Edge Flux Intensity Functions for the Laplacian”, Int. J. Numer. Meth. Engng., Vol. 53, pp. 225-242,
2002 (with Z. Yosibash and R. Actis)

“Analysis of Bonded and Fastened Repairs by the p-Version of the Finite-Element Method” Computers &
Mathematics with Applications, Vol. 38, pp.49-69 2003 (with R. L. Actis)

“The p-version of the finite element method”, Chapter 5 in Vol. 1 of Encyclopedia of Computational Mechanics, E.
Stein, R. de Borst and T. J. R. Hughes, (editors), John Wiley & Sons, Chichester, UK (2004 ISBN) 0-470-
84699-2 (with A. Duester and E. Rank)

“On the importance and uses of feedback information in FEA”, Applied Numerical Mathematics Vol. 52, pp. 219-
234, 2005 (with R. Actis)

“Procedures for the verification and validation of working models for structural shells”, Journal of Applied
Mechanics Vol. 72, pp. 907-915 2005 (with D. Muntges)

Scientific and professional society membership:

The Hungarian Academy of Sciences
American Society of Mechanical Engineers
Society of Engineering Science
International Association for Computational Mechanics (Founding member and fellow)

Honors and awards:

Appointed Visiting Professor, Department of Mathematics, University of Maryland, College Park, MD, 1982
Appointed Albert P. and Blanche Y. Greensfelder Professor, 1977
“Outstanding Engineer in Education” award, St. Louis Chapter, Missouri Society of Professional Engineers, 1985
Honorary doctorate (Dr. h.c.) 1988
Elected to the Hungarian Academy of Sciences 1996

Courses taught during most recent academic year 2005-2006:**Fall semester:**

ME 241 "Mechanics of Deformable Bodies," 3 hours/week lecture, one section, day, undergraduate
ME 546 "Finite Element Analysis," 3 hours/week lecture, one section, evening, graduate

Other assigned duties:

P.I. on two sponsored research projects, Co-Principal Investigator on one sponsored research projects

Participation in specific professional development programs, since 2001:

None

Other duties:

CEC Faculty Advisory Board

CURRICULUM VITAE

Name: Michael C. Wendl

Date of birth: 1 January 1966

Academic rank: Adjunct Professor

Degrees:

B.Sc., Mechanical Engineering, Washington University, 1989

M.Sc., Mechanical Engineering, Washington University, 1990

D. Sc., Engineering and Applied Science, Washington University, 1994

Service on this faculty: 7 years

Original appointment: 1999, Adjunct Professor

Promotions: none

Other related experiences:

Academic:

Research Assistant, Center for Computational Mechanics, Washington University School of Engineering and Applied Science, 1989 – 1991.

Staff Research Associate, Genome Sequencing Center, Washington University School of Medicine, 1994 – Present.

Industrial:

Intern, McDonnell-Douglas Astronautics Co., 1988.

Research Assistant, McDonnell-Douglas Research labs, 1991 – 1994.

Consulting:

Large-Scale DNA sequence processing, The Sangre Centre, Cambridge, United Kingdom (1998).

Professional registration: Missouri, Engineer in Training

Recent journal publications:

Ewing, B., Hillier, L., Wendl, M.C., Green, P., (1998) "Base-calling of Automated Sequencer Traces using PHRED. I. Accuracy Assessment", *Genome Research*, **8** (3), 175-185.

Wendl, M.C., Dear, S., Hodgson, D., Hillier, L., (1998) "Automated Sequence Preprocessing in a Large-Scale Sequencing Environment," *Genome Research*, **8** (9), 975-984.

The C. Elegans Consortium [Waterston, R.H., *et al.*] (1998) "Genome Sequence of the Nematode *C. elegans*: A Platform for Investigating Biology," *Science*, 282 (5396), 2012-2018.

Wendl, M.C., (1999) "A Method for Obtaining Benchmark Navier-Stokes Solutions," *International Journal for Numerical Methods in Fluids*, **31** (3), 657-660.

Wendl, M.C., (1999) "General Solution for the Couette Flow Profile," *Physical Review E*, **60** (5), 6192-6194.

Wendl, M.C., Agarwal, R.K., (2000) "Couette Flow Profiles for Two Non-Classical Taylor-Couette Cells," *Journal of Fluids Engineering*, **122** (2), 435-438.

Wendl, M.C., (2000) "Mathematics and Numeracy," in Encyclopaedia of the United States in the Nineteenth Century, Edited by P. Finkelman, *Charles Scribner's Sons*, New York, In Press.

The International Human Genome Sequencing Consortium, [Lander, E.S., *et al.*] "The Human Genome: Initial Sequencing and Analysis," *Nature*, To Appear.

Wendl, M.C., Marra, M.A., Hillier, L.W., Chinwalla, A.T., Wilson, R.K., Waterston, R. H., "Theories and Applications for Sequencing Randomly Selected Clones," *Genome Research*, To Appear in **11** (2).

Scientific and professional society membership:

American Institute of Aeronautics and Astronautics, Senior Member

Honors and awards:

Member – Tau Beta Pi, Pi Tau Sigma, Delta Phi Alpha

American Institute of Aeronautics and Astronautics St. Louis Section Fellow, 1992

Courses taught during most recent academic year 2005-2006:**Fall semester:**

JME 3710 "Principles of Heat Transfer," 3 credit hours, undergraduate

Spring semester:

JME 3700 "Fluid Mechanics," 3 credit hours, undergraduate

Other assigned duties: none

Participation in specific professional development programs since 1995: none

Other duties: none

APPENDIX I – D

Meetings on Development of Outcomes Based Assessment

MINUTES OF ME RETREAT
November 2, 2001

Attendees:

David Peters
Dick Gardner
Ramesh Agarwal
Phil Bayly
Ruth Okamoto
Michael Swartwout
Guy Genin
Shankar Sastry
Raimo Hakkinen
Mark Jakiela
Ken Jerina
Da-Ren Chen

The meeting began with Prof. Peters giving a "State of the Department" address showing where the Department presently stands in terms of enrollment, graduates, research, and curriculum. Then, Prof. Jerina presented a presentation of National Data on Universities in General, Engineering Programs, Engineering Programs at Cohort Schools, and some conclusions. Third, Prof. Peters presented a summary of findings from our last retreat (2 years ago) including which of the action items from then had been acted upon and which had not.

Next, there was a discussion of faculty size and strategic planning for where the next faculty hires should go. It was agreed that the highest priority was in the Thermal Sciences area. There was some discussion of potential areas of research for such a person including Statistical Thermodynamics, Biothermodynamics, or Classical Thermodynamics. A senior person would be most logical, but there is the question of whether or not we could attract a senior person and what would be the draw for someone like that to come here.

The second priority seems to be that of Applied Mechanics but with an application to Manufacturing of Materials Processing. A close third would be someone in biomechanics to take the place of George Zahalak, recently retired. Each of these would probably be a Senior person if we want to increase our research funding and National reputation.

After this, Professor Gardner presented data on our new advising system and the implementation of our new curriculum, including teaching assignments.

The remaining time of the retreat dealt with ABET 2000 and our visit in five years. The faculty were introduced to the new criteria and to what they would need to do in their courses. The group also worked on a group of Objectives for the Engineering Program including discussion of how their own course objectives would need to be tailored to flow from the overall objectives.

The meeting was adjourned at 2:30 p.m.

Minutes
Joint Undergraduate Committee

April 18, 2001

1:00 PM

Jolley 306

Present: Prof. Bayly, Gardner, Jerina and Peters

The purpose of this meeting was to review each of the Su 2000 Joint program course offerings in Mechanical Engineering in preparation for Summer 2001:

JME 041
JME 221
JME 225
JME 317-8
JME 325
JME 390

Assessment and review:

JME 041 Introduction to Design

This course meets the identified program goals through its quality and quantity of examples and assignments. The instructors need to note the comment from the JME 390 course as related to JME 041.

The next time the course is offered in the summer session, a request will be made from this committee to the Dean's Office that the students fill out the course/professor evaluation for additional feedback. Historically the Dean's Office has provided the forms and their evaluation for the academic year but not the summer session.

JME 221 Energetics for Mechanical Engineers

The committee feels that Goal #2 is not relevant to this course, as no experiments are part of the material or presentation of the course. Goal # 7 should be met by exposure to the instructor who does do engineering consulting work. The instructor's suggestion on changing the order of some of the material presented should be followed.

The next time the course is offered in the summer session, a request will be made from this committee to the Dean's Office that the students fill out the course/professor evaluation for additional feedback. Historically the Dean's Office has provided the forms and their evaluation for the academic year but not the summer session.

JME 225 Materials Science

Goal # 3 identified, as part of the course might be weak unless the instructor can identify more clearly next time how much time is spent on materials selection to satisfy engineering needs. Program goal #4 should be added to this course as it has a one-unit lab in which the students do write lab reports for 25% of their grade in the course. The experimental teams are rather large and it is recommended to see if they can be reduced to 3-5 people in order to give a better "hands-on" experience. Three students per group might be optimal.

The next time the course is offered in the summer session, a request will be made from this committee to the Dean's Office that the students fill out the course/professor evaluation for additional feedback. Historically the Dean's Office has provided the forms and their evaluation for the academic year but not the summer session.

JME 317-318 Dynamic Response of Physical Systems

The instructor needs to list more clearly how the Homework, exams and lab exercises are correlated with the Program Goals 1-10. This should be done when the course is offered in the summer of 2001.

The next time the course is offered in the summer session, a request will be made from this committee to the Dean's Office that the students fill out the course/professor evaluation for additional feedback. Historically the Dean's Office has provided the forms and their evaluation for the academic year but not the summer session.

JME 325 Materials Selection in Engineering Design

The identification of Program Goal #2 for this course is weak as no experiments are performed in this course. If the link is the discussion of experimental data from experiments, the instructor should make this more clear in his Su 2001 assessment. The instructor should provide a mapping of the course goals into program goals

The next time the course is offered in the summer session, a request will be made from this committee to the Dean's Office that the students fill out the course/professor evaluation for additional feedback. Historically the Dean's Office has provided the forms and their evaluation for the academic year but not the summer session.

JME 390 Senior Design Project

The instructors in JME 041 need to be advised of the instructor's identification of lack of complete coverage of surface finishes and tolerances in JME 041. The course evaluation by the instructor is rather extensive and complete indicating that the course objectives are being met and the identified Program Goals are being realized.

The next time the course is offered in the summer session, a request will be made from this committee to the Dean's Office that the students fill out the course/professor evaluation for additional feedback. Historically the Dean's Office has provided the forms and their evaluation for the academic year but not the summer session.

The next meeting of the Joint Undergraduate Committee will be May 2 at 1:00 PM in Jolley 306. The Joint Program courses from F2000 will be reviewed at this meeting: JME 222, 271, 280, 331, 381, 394.

Respectfully submitted,

Richard A. Gardner

Minutes

Joint Undergraduate Committee

May 2, 2001

1:00 PM

Jolley 306

Present: Profs. Bayly, Gardner, Jerina and Peters

The purpose of this meeting was to review each of the F 2000 Joint program course offerings in Mechanical Engineering in preparation for the F01 Semester.

JME 222
JME 271
JME 280
JME 331
JME 381
JME 394

Assessment and review:

JME 222 Introduction to Machine Design

Review Program Goals No. 4 and No. 5 for this course. The course does not have group projects or presentations so it would be best to take these goals off the list for JME 222. The next time the course is evaluated a 2-D matrix should be created which lists the Program Goals vs. course content in order to easily identify how the goals are being met.

JME 271 Principles of Heat Transfer

Review Program Goals No. 4 and No. 5 for this course. The course does not have group projects or presentations so it would be best to take these goals off the list for JME 222. The next time the course is evaluated a 2-D matrix should be created which lists the Program Goals vs. course content in order to easily identify how the goals are being met.

JME 280 Fluid Mechanics Laboratory

Very good course assessment. The next time the course is evaluated a 2-D matrix should be created which lists the Program Goals vs. course content in order to easily identify how the goals are being met.

JME 331 Control Systems I

Complete assessment. Very good. Mapping of the course goals a good idea. The next time this course is reviewed the "a" through "k" Program Goals need to be updated to the current ten Program Goals.

JME 381 Air Conditioning Systems and Equipment I

Take off goal # 2. Even though the students are working with experimental data and the source of these data might be discussed in the course, they are not actually doing any experiments which is the spirit of Goal #2. The next time the course is evaluated a 2-D matrix should be created which lists the Program Goals vs. course content in order to easily identify how the goals are being met.

JME 394 Mechanical Engineering Design Lab

Add Program Goal # 5 to the course and evaluation process. This is a lab course and the students should be getting exposure to group and individual lab projects. The next time the course is evaluated a 2-D matrix should be created which lists the Program Goals vs. course content in order to easily identify how the goals are being met.

The next meeting of the Joint Undergraduate Committee will be in late August at 1:00 PM in Jolley 306. The Joint Program courses from W2001 will be reviewed at this meeting: JME 141, 204, 220, 270, 281, 331, 380, and 382.

Respectfully submitted,

Richard A. Gardner

Minutes

Joint Undergraduate Committee

August 28, 2001

11:00 AM

Jolley 306

Present: Profs. Gardner, Jerina and Peters

The purpose of this meeting was to review each of the W 2001 Joint Program course offerings in Mechanical Engineering in preparation for the W02 Semester. The instructors who taught in the W01 semester provided course assessments.

Under review:

JME 141
JME 204
JME 220
JME 262
JME 270
JME 281
JME 380
JME 382

The meeting began with discussions concerning ten Program Goals for the Joint Program. It was suggested that the words "experimental data" be added to the goal in the future because many of our courses discuss, examine and utilize experimental data in the analysis or design of systems. Unanimous agreement was found. Goal #2 shall now read:

2. *Design, modify, conduct and/or analyze experiments and experimental data in the areas of thermal-fluid sciences, solid mechanics and dynamical systems.

It was suggested that 0.5 units of design be awarded in JME 221. This course already has had design content but this gives formal recognition to the present practice. Unanimous agreement was found for this proposal.

Assessment and review:

JME 141 Mechanics of Deformable Bodies

Dr. Actis has provided an excellent and complete review and assessment of his course on deformable bodies. The committee makes no suggestions for improvements.

JME 204 Analytical Approaches to Design

Dr. Swartwout has provided a very good assessment of what was covered and included several areas that need improvement. The committee agrees and encourages him to implement the changes next winter semester.

JME 220 Thermodynamics

Dr. Pitt's assessment was not available at the time of the meeting. This course will be reviewed through the mail so that the members of the committee can make suggestions for improvement.

JME 262 Materials Engineering

Dr. Sastry indicated that goal #2 was being met. In light of the change we plan to make in the formal statement of goal #2, it will be goal #2 which will change not Dr. Sastry's assessment of his attainment of the goal in his class. The performance of the students in several areas of Dr. Sastry's assessment should be added and the matrix of goals vs. course topics needs to be improved.

JME 270 Fluid Mechanics

This is almost a complete review. A matrix of program goals vs. course topics needs to be added.

JME 281 Heat Transfer Laboratory

Acceptable course assessment. Omit Program Goal #8, as it is not covered adequately in this course.

JME 380 Building Environmental Systems

Remove Program Goals 4 and 5, as they are not covered adequately in this course. Expand with more details Goal #1. Identify specific examples in Goal #6. Remove Goal #9, as it is not covered to any degree in this course. Add performance assessment as to

how well the students did in each of the topical areas covered. Concerning Goal #7, the background and professional activities of Dr. Janis should be mentioned.

JME 382 Air Conditioning Systems and Equipment II

Performance information as to how well the students did in each of the areas mentioned needs to be added. Is the matrix of goals of the Joint Program vs. course topics available?

The next meeting of the Undergraduate Committee to review the courses offered in the F01 semester will take place in January 2002.

Respectfully submitted,

Richard A. Gardner

Minutes

Joint Undergraduate Committee

October 18, 2001

2:30 PM

Jolley 306

Present: Profs. Bayly, Gardner, Jerina and Peters.

The purpose of this meeting was to review each of the Su 2001 Joint Program course offerings in Mechanical Engineering in preparation for the Su 2002 Semester. The instructors who taught in the Su 2001 semester provided course assessments.

Under review:

JME 041
JME 225
JME 317
JME 318
JME 390
JME 325

The meeting began with discussions concerning the general assessment process. Most of the instructors had provided detailed information as to how his course was providing lectures and materials relevant to the course goals but most were weak in assessing exactly how well the course goals were being achieved by the students. It was concluded that the instructors be asked next time to provide a rating on a scale of 1-10 how well the particular goals were being achieved. The "goals" at the end of the course are "outcomes" in the language of ABET and will be so called in the future. The students will also be asked to rate each of the course's outcomes on a scale of 1-10 in order to get their perception of how well the outcomes were achieved.

Assessment and review:

JME 041 Introduction to Engineering Design

The assessment indicated that some improvement is needed in the performance of students in the design contest. The instructor plans to improve this weakness. The student shop needs a new lathe.

JME 317-8 Dynamic Response of Physical Systems

The instructor needs to be more explicit in explaining his assessment as to whether the particular goals of the course are being met and at what level of student performance for each goal.

JME 225 Materials Science

The assessment is very complete in explaining what is being done to meet each of the objectives of the course. More information concerning the level of student performance should be included. The assessment could be made more concise.

JME 390 Senior Design

The instructor examined the student's level of preparedness at the beginning of the course and then tested them again with the same questions at the completion of the course. This was judged to be a very effective way to determine both the level of the student's meeting the course outcomes and the "value added" by their taking the course. This might be adopted by all of the courses.

JME 325 Material selection in Engineering Design

The instructor's course assessment has not yet been received, so this course will be examined in January, 2002.

The next meeting of the Undergraduate Committee to review the courses offered in the F01 semester will take place in January, 2002.

Respectfully submitted,

Richard A. Gardner

JME041 Assessment of Objectives for Summer 2001 Course

1. **Apply fundamental scientific and engineering concepts involving Dynamics and Systems, Material Science, Mechanics and Solids and the Thermal-Fluid Sciences in order to identify, formulate and solve a variety of mechanical engineering problems.**

Assessment: N/A

2. **Design, modify, conduct and analyze experiments and experimental data in the areas of thermal-fluid sciences, solid mechanics and dynamical systems.**

Assessment: Students are developing proficiency in designing/running simple physical experiments; they are learning how to interpret our deliberately vague lab instructions and identify the parts of the instructions that require them to develop an experimentation plan. They are also more capable of answering the "whys" of how the labs are constructed and run.

3. **Directly perform system, process and component selection in order to satisfy specific engineering-related needs through the application of mechanical design philosophy in engineering practice.**

Assessment: Students "learned by doing" the selection process. A few have grasped the concept very well, performing simple experiments to verify their concept & sizing design decisions early in the contest. It might be useful to specifically ask all students to perform such tests.

However, the JME041 summer session contest projects continue to be "low performers" compared with the Joint Program students participating in the school-year sessions. The instructor has not yet determined whether it is the class timing (one, three-hour session in the evening) or something in his teaching style that is encouraging low performance. In the next class, the instructor will try to more closely engage with the students during their concept generation and development process in the hopes that he can encourage more ambitious (and effective) contest designs.

Similarly, it would be helpful to encourage/require functional testing in advance of the dry run; most students had significant difficulties with the dry run because it was the first time that they tried to meet all the contest goals at once.

4. **Communicate in oral and written presentations using graphic and/or visual media appropriate for an engineering business environment.**

Assessment: Students' concept sketches and pre-CADs were adequate but not spectacular. It might be beneficial to allow resubmissions/revisions (allowing students to

respond to feedback). The instructor will devote more time to explaining the roles and requirements of concept sketches & part drawings.

5. Operate productively in individual or multidisciplinary, team-oriented projects.

Assessment: Students worked well in teams, although there were some configurations that inevitably led to more socializing than progress. The instructors' policy of choosing the groups himself seems to be effective at reducing the social groupings.

6. Be exposed to modern developments, products and tools as they relate to engineering practice.

Assessment: Students have developed proficiency with basic shop tools and have demonstrated competency (based on the results of their contest entries). Some of the shop tools (the lathe, most notably) need to be upgraded.

7. Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards.

Assessment: N/A

8. Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts.

Assessment: N/A

9. Recognize the need for (and obtain the tools necessary to engage in) life-long learning.

Assessment: This need was not well-met in the summer session; this is because the main contribution to life-long learning is the CAD portion. Only one student took the CAD section in Summer 2001.

10. Be afforded the opportunities to participate in cooperative education, internships, research experiences or international exchange programs in order to gain experience beyond the classroom

Assessment: N/A

**Course Objectives
JME317 & JME318
Summer 2001**

1. **Apply fundamental scientific and engineering concepts involving Dynamics and Systems, Material Science, Mechanics and Solids and the Thermal-Fluid Sciences in order to identify, formulate and solve a variety of mechanical engineering problems.**

Assessment: Dynamic analyses were applied in the analysis of single-degree and multi-degree of freedom vibratory systems. Seven homework assignments were given the students that reinforced vibration/modal analysis techniques taught in the lectures. The homework was designed to reinforce concepts learned in lectures. Most of the homework problems were dynamic/vibratory analysis of basic mechanical engineering equipment/problems.

2. **Design, modify, conduct and analyze experiments and experimental data in the areas of thermal-fluid sciences, solid mechanics and dynamical systems.**

Assessment: In the JME318 Lab the students conduct 6 experiments. Four of the labs involve vibratory measurements of single and multi degree of freedom systems. The measured results are compared with analytical predicted results. Two additional labs involve the design of vibration isolation equipment.

3. **Directly perform system, process and component selection in order to satisfy specific engineering-related needs through the application of mechanical design philosophy in engineering practice.**

Assessment: This Goal is not applicable for this class.

4. **Communicate in oral and written presentations using graphic and/or visual media appropriate for an engineering business environment.**

Assessment: Each student in JME318 presented a written laboratory report for each of the six assigned laboratory experiments. Each student turned in written homework assignments for JME317.

5. **Operate productively in individual or multidisciplinary, team-oriented projects.**

Assessment: Students operated individually in their homework assignments and exams for JME317. The students were allowed to work in groups of two for JME318 with regards to submitting a laboratory report for the non-design experiments. Each student for JME318 submitted an individual laboratory report for the two design experiments. The student's productivity increased during the semester as measured by the increase in the average exam scores from 74 for the 1st exam to 81 for the 2nd exam.

compare this years to last year's result.

6. **Be exposed to modern developments, products and tools as they relate to engineering practice.**

Assessment: Dr. Dale M. Pitt, the instructor for this class, is a Boeing Associate Technical Fellow. Dr. Pitt discussed the vibratory/dynamics issues and challenges he was facing at work in the Boeing Phantom works. These discussions include a video presentation of F-18 wind tunnel and flight flutter testing, F-18 landing simulated "Drop Test", and F-18 dynamic weapon ejection responses. The students were required to use MATLAB® for the analysis of three homework problems. MATLAB® is a state-of-the-art analysis and plotting tool that is rapidly becoming a standard engineering industry practice.

7. **Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards.**

Assessment: Dr. Dale M. Pitt is a registered professional engineer in the state of Missouri. Dr. Pitt, on many occasions, discussed ethical aspects of engineering as related to his primary job at the Boeing Phantom Works.

8. **Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts.**

Assessment: This Goal is not applicable for this class.

9. **Recognize the need for (and obtain the tools necessary to engage in) life-long learning.**

Assessment: The students were taught the need for life-long learning in the engineering profession, Dr. Pitt discussed his three recent technical papers he authored and presented at technical conferences during the last year. The need for continual learning and the process of learning was stressed throughout the semester. The students were encouraged to buy MATLAB® and learn it's use for JME317, JME318 and other engineering classes.

10. **Be afforded the opportunities to participate in cooperative education, internships, research experiences or international exchange programs in order to gain experience beyond the classroom**

Assessment: This Goal is not applicable for this class.

Course Objectives

- 1. Apply fundamental scientific and engineering concepts involving Dynamics and Systems, Material Science, Mechanics and Solids and the Thermal-Fluid Sciences in order to identify, formulate and solve a variety of mechanical engineering problems.**

Assessment: Throughout the course we emphasize the application of fundamental scientific and engineering concepts. Materials science is presented as the interrelationship of properties, structure, and processing of materials. Lectures are divided into these three broad areas viz., properties, structure, and processing. Laboratory experiments conducted in parallel emphasize these three areas.

- In the first few lectures, we discuss the basic mechanical properties which are key to the prediction of the behavior of a component under applied static and dynamic loads and selection of materials for different applications. Tensile, compressive, fatigue, fracture toughness, and creep properties are defined, and experimental methods of determination of these properties are discussed. Students perform three experiments: (i) Tensile testing of materials, (ii) Hardness testing, and (iii) Impact testing.
- In the next series, we discuss the structure of materials at different levels viz., the individual atomic level, aggregates of atoms, microscopic, and macroscopic. The similarities and differences in the structure at each level of metals, polymers, and ceramics are discussed and related to the properties. Students perform three experiments related to the structure of materials: (i) Analysis of different crystal structures using three dimensional models made up of ping-pong balls, (ii) Crystal structure determination by x-Ray diffraction, and (iii) Study of microstructures using optical microscopy.
- In the final series of lectures, we discuss the different processing methods used to control the structure and properties of materials. After a brief introduction to the solid state diffusion and strengthening methods, the students are introduced to phase diagrams and phase transformations. The use of phase diagrams in controlling the microstructures of various metals and alloys and ceramics is discussed. The course concludes with a discussion of deformation and processing of polymers. Three experiments related to processing are: (i) Heat Treatment of Steels, (ii) Strain hardening, and (iii) Precipitation Hardening.

The ability of students to apply the fundamental materials science concepts to identify, formulate and solve a variety of mechanical engineering problems was assessed by requiring the students to complete successfully five home work assignments and three examinations. In each home work assignment, twenty problems were assigned. In all assignments, about 70-80% of the problems involved the application of fundamental concepts to solving a variety of mechanical engineering problems; the remaining 20-30% of the problems were formulated to test the understanding of concepts. In each of the three examinations, half the number of questions were testing of students' understanding of concepts, and the remaining half the number of questions were numerical calculations to test of students' ability to analyze the problems logically, use the correct formulae, and determine whether the answers were reasonable. In homework assignments, students generally scored in the range 75-100% with the mean being about 90%. There was a wider range in the examination grades; the range was typically 60-100% with a mean of 80%. After grading of each examination, the common mistakes made by students, and some key concepts to pay attention were discussed.

- 2. Design, modify, conduct and analyze experiments and experimental data in the areas of thermal-fluid sciences, solid mechanics and dynamical systems.**

Assessment: • Students conduct a total of nine experiments. In each of these experiments, students have to select appropriate test parameters (such as temperature, time, stress, strain rate, etc) and have to modify as needed. Upon completion of these experiments, the students will have gained experience in this area. These experiments are supplemented with assignments in which several assigned problems deal with analysis of experimental data, for example correlating strength with grain size, answering such questions as why certain metals and alloys are ductile (based on crystal structure and defect structure), interpreting creep data, optimizing cold working for strength and ductility, etc.

Students readily grasped the concepts involving numerical calculations (such as tensile, hardness, and toughness tests), however some students had difficulty in visualizing and analyzing experiments with three dimensional atomic arrangements, crystal structures, and microstructures. Ping-pong ball models and three dimensional computer models were used successfully to supplement text book material.

3. Directly perform system, process and component selection in order to satisfy specific engineering-related needs through the application of mechanical design philosophy in engineering practice.

Assessment. About one third of the lectures are devoted to the discussion of the basic mechanical properties of detterent materials which are key to the prediction of the behavior of a component under applied static and dynamic loads and selection of materials for different applications. About 25-30% of the assignments deal with design problems which require the students to work out problems related to process and component selection. Representative examples include the prediction of the life of a structural component containing a crack of a certain size, determining the life of a component subjected to creep at high temperatures, calculating the magnitude of stress relaxation in a polymer subjected to constant strain, determining the thermomechanical processing schedule to produce a certain strength in an alloy.

4. Communicate in oral and written presentations using graphic and/or visual media appropriate for an engineering business environment.

Assessment: Students are encouraged to participate in class room discussions. Throughout the lectures, the instructor solicits responses from students for questions directly related to the topic being covered during that lecture, previous lectures, and some recent developments in the field. Every attempt is made to get participation from each and every student. A team of 3-4 students conduct a total of nine laboratory experiments. Each student prepares nine written laboratory reports. The laboratory participation and written reports constitute 25% of the total grade.

5. Operate productively in individual or multidisciplinary, team-oriented projects.

Assessment: The assignments are multidisciplinary - they combine physics, chemistry, and engineering and they are completed by the individuals. The laboratory experiments are conducted as a team of 3-4 students.

6. Be exposed to modern developments, products and tools as they relate to engineering practice.

Assessment: The instructor who has had extensive industrial experience makes it a point to bring to the class room real world engineering examples. Because the instructor is active in materials research,

extensive coverage is given to the modern developments in the field of materials science. The instructor draws from his consulting assignments real life examples .

7. **Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards.**

Assessment: This goal was not addressed in the course.

8. **Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts.**

Assessment: The relevance of broad-based education to engineering solutions with global and societal impact is covered with appropriate examples; for example the need for reducing the weight of automotive and aircraft to lower the fuel consumption, the need for developing high performance materials to improve the efficiency of land and air based transportation, the need for developing non-lead containing solders,.. etc - such topics are discussed throughout the lectures.

9. **Recognize the need for (and obtain the tools necessary to engage in) life-long learning.**

Assessment: Throughout the course the fundamental principles and building blocks are emphasized and also the point is made that the application of these fundamental principles to a specific problem is a life-long learning process.

10. **Be afforded the opportunities to participate in cooperative education, internships, research experiences or international exchange programs in order to gain experience beyond the classroom**

Assessment: Ample opportunities are provided for the students to participate in co-op programs internships, and research experience. Upon completion of the course, several students have taken up co-op positions and internships in materials related areas and some students have worked in the instructor's research laboratory

JME 390 Senior Design Project – Summer 2001

Course assessment:

General comments:

By the time students take this course they have been in a series of engineering science classes where the norm is closed form, preferably analytic, rather than open-ended design solutions. The challenge in this course is to free students' minds in order to utilize the inherent freedom in engineering design for the development of better products and the benefit of humankind. In order to identify the efficacy of the course in meeting the above stated objectives the students were asked to provide their opinions on the six (6) questions on the attached pages. Similar questions had been discussed as examples of design problems near the beginning of the course. The students were asked to comment on the change in their perception of design as a result of taking the course.

Near the beginning of the course answers to question (1) indicated a clear understanding on the importance of engineering calculations on the feasibility of mechanical engineering products. Answers to question (2) were vague and confused with innovation in product functions. Answers to questions (3) and (5) indicated a haphazard and random approach to the problem. Answers to question (4) indicated the students would start their design with an arbitrary and emotional specification the car should have "1.3 to 2.0 times the power of the VW Jetta", without first developing the justification of this specification for the US market, and this dominated the rest of the thought process. Answers to question (6) indicated the students would not know where and how to find information needed in order to proceed with this design problem.

Their answers to the same questions at the end of the course are in the attached pages, and they indicate that the course objectives were met.

1) Prepare students to be contributing members in practicing engineering design teams.

By the end of the course students understood the importance of the sequence of the four stages of design, and the integral role of science and engineering analysis and design in product development. Furthermore, they understood the importance of teamwork, constructive contributions in design sequences, integrated product teams, and the ways to join a design team into any stage of an ongoing design process.

2) Enable students to perform engineering design solutions (applying scientific and engineering principles), rather than "trial and error" (I hope this will work) design solutions.

The initial error of coming up with a preconceived notion of a full design solution before considering alternatives was overcome in about two weeks. The initial reluctance to use design freedom, to make assumptions, design loops, and return to make corrections to the design sequence were overcome in about 3 weeks. Then the students understood the principles of embodiment design, and the integral role of modeling engineering processes and systems in order to analyze their designs.

3) Enable students to envision, create, and critically evaluate alternative designs, and choose optimal designs among them.

All students were applying the principles of feasibility study, alternatives evaluation, and embodiment design by the fourth and fifth week of the course.

- 4) *Enable students to function in the iterative nature of design without being lost by the inherent design freedom.*

The design conferences enabled students to benefit from each other's ideas and expertise, and the schedule of preliminary and final reports forced the students into structured ways of design iterations. By the end of the course all students had seen the iterations in all design projects in the course, and felt familiar and comfortable with the process.

- 5) *The students are able to conduct (participate in or lead in) the four stages of design process (concept, feasibility, embodiment, detailed design), starting from any of the four stages (e.g., starting from another team's feasibility or embodiment design).*

The design conferences enabled students to contribute as members of several design teams, so that by the end of the course they were familiar with all design projects in the course. During the latter 60% of the course all students were making intellectual contributions to all projects, not just their own. Extrapolating from this class observation, we feel that students would be able to achieve this objective in actual engineering practice.

- 6) *Design engineering products with optimal use of the various alternative (continuously evolving) manufacturing techniques, materials, controls.*

The set of lectures, examples, and the design projects provided the students with expertise on how to integrate material from several engineering and science areas to achieve their design goals. Furthermore, it became clear that engineering practice is evolving, requiring that we keep updated on new skills and technologies.

- 7) *Design engineering products that meet regulatory, safety, environmental standards.*

The lectures, guest lecturers, and case-study materials instilled in the students the importance of these areas in engineering practice, and the perils of ignoring them.

- 8) *Enable students to study on their own further design concepts.*

By the end of the course students felt familiar with finding and absorbing new technical information, and using it in their designs.

A discussion of the student's revised answers to question (1)-(6) indicated a clear understanding on the engineering design process and concepts, and that the course objectives were met. In addition, after a series of presentations and discussions, all students were able to present technical material to a group of their peers, and to be contributing members of mechanical engineering design teams.

Suggestion:

Over the years there is a continuing decrease of the use of surface finishes and tolerances in course projects. We should make sure that these are adequately covered in earlier drafting classes, and continue to encourage students to use them in their drawings. This was accomplished to some degree this year, but there are indications that students need additional preparation in that area before they enter in this class.

Theodosios Korakianitis
August 2001

JME 390 – Summer 2001

First Name:

Last Name:

Local Home Telephone:

email:

Work Telephone:

email:

In order to answer the following questions, make engineering assumptions as necessary. Marks Standard Handbook for Mechanical Engineers is Available.

1. Identify five differences between Mechanical Engineering Design and Artistic Design?
(5 minutes)
2. Define Mechanical Engineering Design (5 minutes)
3. You work for a retailer supplying home-improvement products. Outline the steps required to design a mechanically-activated domestic one-car garage door mechanism.
(10 minutes)
4. You work for an automotive company. Outline the steps required to choose the main engine characteristics (displacement, number of cylinders, design rpm, power and torque etc) for a mid-size sedan to compete with the new VW Jetta.
(15 minutes)
5. Outline the steps required to design an AC-driven water pump for a 35,000 gallon underground swimming pool capable of circulating the pool water in 90 minutes.
(10 minutes)
6. Outline the steps required to design the main propeller shaft for a low speed marine diesel engine. The engine delivers 60,000 hp at 80 rpm. The shaft is 15 m long. The stern bearing is 1 m long. The 6-bladed propeller weighs 12,000 kg. See the sketch below.
(15 minutes)

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**Washington University in St. Louis
School of Engineering and Applied Science
ABET/NCA Accreditation Preparation
June 4, 2003, 2:00 to 4:00 p.m.
Sever 300
Agenda**

- | | | |
|------|--|----------------|
| 2:00 | Introduction and review of key dates | Bill Darby |
| | <ul style="list-style-type: none">• September 30, 2003: Assessment report due to University• January 30, 2004: NCA report due to University• January 31, 2004: UM-St. Louis interim report for ME due to ABET• July 1, 2005: WU (and UM-St. Louis Joint Program?) self-study reports due to ABET for Fall 2005 accreditation visit• July 1, 2006: UM-St. Louis Joint Program self-study reports (CE, EE, ME) due to ABET for Fall 2006 accreditation visit | |
| 2:10 | Overview of EC-2000 | Chris Kroeger |
| 2:30 | Our experiences with ABET and EC-2000 | |
| | <ul style="list-style-type: none">• Civil Engineering ABET accreditation of UM-St. Louis Joint Program | Kevin Truman |
| 2:55 | <ul style="list-style-type: none">• Electrical Engineering ABET accreditation of UM-St. Louis Joint Program | Barry Spielman |
| 3:20 | <ul style="list-style-type: none">• Mechanical Engineering ABET accreditation of UM-St. Louis Joint Program | Dave Peters |
| 3:45 | Wrap-up and next steps | All |
| 4:00 | Adjournment | |

The consensus on how classes are organized, scheduling of events, and the types of classes offered, was a positive one. Some of the negative points, focused on the spacing of the finals, the number of EE requirements, the coordination between courses, the types of courses offered, and the ability of students to see the courses what were to be offered a semester or two in advance. The following is a list of opinions voiced during the meeting:

- The final schedule needs to be spread out
- EE classes need to be reworked for Mech E's
 - o EE 280 is not that beneficial
 - o EE 290 is interesting but is not applicable towards ME jobs
 - ♣ Maybe another EE class in not needed past EE 280
- Related classes, such as ME 320-321, need to be better coordinated
- There needs to be a check system to ensure that classes offered over the summer, and offered at night to UMSL students have the same standards as the regular classes
- The course catalog should be available a semester or two in advance
- The curriculum needs to be more diverse through different disciplines such as a Biomech. Course.

Besides a few classes that need to be reorganized, or a few classes which should be added, there was very few issues with the current curriculum. A few notable comments focused on ME 322A needing to add more machine design, the Probability and Statistics course needs to be used elsewhere in the curriculum, and EP 310 needs to discuss journal papers and thesis. Here are the other comments:

- Statics does a good job.
- The ME section of ME325 is good but the Ch.E section does not do a good job preparing ME majors.
- ME201 is a good course but needs to substitute some aero for space.
- There is no uniformity of the CS 265 sections
 - o It would be nice to have a class dedicated to programs such as MATLAB which are used later
- EN120 is unnecessary if you know what field you want to get into
- The CAD lab needs to be upgraded, and made open to the public

Services offered to the students by the Engineering School were also discussed. It was agreed upon by everyone that the machine shop is doing a great job of allowing interested students the opportunity to build there own parts, and that Pat Harkins does a great job of teaching how things are used. Other services offered by the school are not so helpful, specifically the career center. Most questions are directed to the website, and most companies are local companies. There is also no help finding graduate schools.

RETREAT AGENDA – JANUARY 21, 2005

- Convene at Whittemore House (upstairs, Dean’s Room) 9:30 p.m.
- I. Future Directions of ME/AE 9:45 a.m.
- A. Our strengths
 - 1. Bionmechanics
 - 2. Aerospace
 - 3. Applied mechanics
 - 4. Aerosols and nanotechnology
 - 5. Materials
 - B. New Goals and aspirations for ME
 - 1. Research opportunities in key areas, new directions
 - 2. Possibilities of sustainable research funding in current areas
 - 3. Key faculty that we need to add
 - 4. Discussion
 - C. Sustainable growth
 - 1. History and Impact of UMSL program - Gardner
 - 2. From where would five new faculty be chosen?
 - 3. Financial viability
 - 4. Laboratory support
- Coffee Break 11:00 a.m.
- II. Where we have come from. 11:15 a.m.
- A. Presentation of Goals from last retreat (March 9, 2001) – Peters
 - B. Analysis of where we have come since then. – Peters
 - C. History and make-up of ME faculty – Gardner
 - D. Change in graduate student funding and recruitment
 - D. Discussion of past and future
- III. Teaching Loads and Courses 11:45 a.m.
- A. Presentation of course cycles – Jerina
 - B. Analysis of ME and Aero Degrees and teaching
 - C. Analysis of minors and teaching requirements – Jerina
 - 1. aerospace
 - 2. nanotechnology
 - 3. manufacturing
 - 4. robotics
 - 5. environmental
 - D. Discussion
- Lunch 12:30 p.m.
- IV. ABET Accreditation Issues - Gardner 1:00 p.m.
- A. Mission Statement

- B. Objectives and Outcomes
 - C. Procedure for Quantification
 - D. Record keeping for upcoming visit
- V. ME Qualifier 1:30 p.m.
- A. History of Qualifiers in ME/Applied Mechanics
 - B. Strengths and Weaknesses of present system
 - C. Idea for post mortem on those who do poorly (Rich Axelbaum)
- Coffee Break 2:00 p.m.
- VI. How Schools are ranked 2:15 p.m.
- A. Ranking algorithms – Bill Darby
 - B. Our rankings compared to other schools
 - C. Our raw data compared to other schools
 - D. Discussion
- VII. Summary and Other ideas 2:30 p.m.
- A. Review of what has been presented
 - B. Discussion of new ideas
 - C. Setting of Goals for Department
- VIII. End 3:30 p.m.

1/21/05 RETREAT CONCLUSIONS

1. The UMSL program is a large drain on our faculty efforts, especially the drain of advising over 100 students, each with a completely different set of transfer courses and background. Dick Gardner, Phil Bayly, Ken Jerina, and Mark Jakiela have been bearing this load since Michael Pauken left. The load is affecting their ability to do their other work, including their ability to write proposals and fund students. Advising this group of UMSL students is really a full-time job that could be done by someone who was not a tenure-track professor. We recommend that some of the funds from UMSL used by the Dean's Office be used to hire a full-time, non-tenure-track advisor.

2. We are all fully on board for ABET 2000. We have reviewed the goals, objectives, and mission statements of both of our programs. We are preparing materials for the self-study evaluation and visit in 2006. We recommend that the School implement the FEA exam for students as soon as possible.

3. We are now in the black financially for two years in a row, and it looks like next year will be even better. Part of this is because we have doubled our research income over the past seven years through the hire of key people. Part of this is because we added Aerospace as a major at exactly the right time. We are receiving an influx of undergraduates from the freshmen class and graduate students from local industry. However, with these new students comes the need to expand more sections. Some of our Junior and Senior courses are pushing 60 students per section. Our introduction to design has seventy people in five sections, an all-time record. We will soon be at a point where we will need to split into more sections and require more faculty teaching. It is time to expand our faculty.

3. The present strengths of our Department are in Aerospace, Biomechanics, Environmental/Nanotechnology, and Materials. We are undersized as compared to other ME (and especially other MEAE) Departments with whom we compete. Barna Szabo will retire in May 2006, and we need to start thinking of where we should hire new faculty. The additions of Ramesh Agarwal, Da Ren Chen, Michael Swartwout, Amy Shen, and Eliot Fried are great examples of how adding new faculty can improve our fiscal performance while, at the same time, increase our national prestige and impact. As we think about new faculty, below are some strategic areas:

- Computational solid mechanics (with interactions in Aerospace, Bio, or Nano)
- CFD and Turbulence modeling for aerospace and environmental
- Aircraft Design and Control (we are strong on space side but weak on airplane side) our design faculty are over-worked
- Someone to do experimental fluid dynamics (but we cannot afford research in that area, start-up too high) maybe part-time person
- Faculty with strength in microscopy

We would look for best persons, period, who could fall into one of these areas.

4. In terms of course offerings, we need to revamp our entire curriculum at the senior elective and graduate level. We need a course that would serve as a transition between Deformable Bodies and Elasticity that would give the basic introductions to concepts of plasticity and continuum mechanics. We need a course in kinematics that would feed into the other Mechanics courses. We need to revitalize our aerodynamics curriculum including turbulence, experimental aerodynamics, and simply an upgrade to the twenty-

first century. We also are finding that, since Kevin Truman stopped teaching statics, the quality of what our students are learning in that course is going down. We will talk with CE about this. If nothing can be done, we may have to teach it ourselves. Finally, we need to offer some biology courses as possible for senior electives.

5. We are very poor in technical staff, especially in the senior design course for prototyping and in the undergraduate labs. We need another Pat Harkins, we need an experimental technician, we need another secretarial staff.

APPENDIX I – E

Correlation of ME Courses, Outcomes, and Objectives

Definitions:

- **Program Outcomes:** Statements that describe what the students are expected to know and be able to do at the time of graduation.
- **Program Educational Objectives:** Statements that describe the expected accomplishments of graduates during the first few years after graduation.

ME Program Outcomes

- a. An ability to apply knowledge of mathematics, science, and engineering.
- b. An ability to design and conduct experiments, as well as to analyze and interpret data.
- c. An ability to design a system, component, or process to meet desired needs.
- 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. Through broad education, an ability to understand the impact of engineering solutions in a global and societal context.
- i. A recognition of the need for, and an ability to engage in 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.

ME Program Educational Objectives

1. Apply fundamental scientific and engineering concepts involving Dynamics and Systems, Material Science, Mechanics and Solids and the Thermal-Fluid Sciences in order to identify, formulate and solve a variety of mechanical engineering problems.
2. Design, modify, conduct and analyze experiments in the areas of thermal-fluid sciences, solid mechanics and dynamical systems.
3. Directly perform system, process and component selection in order to satisfy specific engineering-related needs through the application of mechanical design philosophy in engineering practice.
4. Communicate in oral and written presentations using graphic and/or visual media appropriate for an engineering business environment.
5. Operate productively in individual or multidisciplinary, team-oriented projects.
6. Be exposed to modern developments, products and tools as they relate to engineering practice.
7. Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards.
8. Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts.
9. Recognize the need for (and obtain the tools necessary to engage in) life-long learning.

The nine **Program Educational Objectives** of the Joint Mechanical Engineering Program identify specific objectives to be achieved by each and every graduate of the program. The **Program Outcomes** and the nine **Program Educational Objectives** are correlated with each other in Table I-E1 Objectives vs. Outcomes. All **Program Outcomes** (a) through (k) are covered in the nine **Educational Objectives**. Each individual course, on the other hand, is correlated with both the **Program Educational Objectives** and **Program Outcomes** in Table I-E2. In addition, the course material for each course is correlated with the **Program Educational Objectives**. A sample of this correlation for one course, JME 141 Deformable Bodies, is shown in Table I-E3 which follows.

Table I-E1 Objectives vs. Outcomes

- 1. Apply fundamental scientific and engineering concepts involving Dynamics and Systems, Material Science, Mechanics and Solids and the Thermal-Fluid Sciences in order to identify, formulate and solve a variety of mechanical engineering problems.**
Program Outcome (a) an ability to apply knowledge of mathematics, Science, and engineering
Program Outcome (e) an ability to identify, formulate, and solve engineering problems
- 2. Design, modify, conduct and analyze experiments in the areas of thermal-fluid sciences, solid mechanics and dynamical systems.**
Program Outcome (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- 3. Directly perform system, process and component selection in order to satisfy specific engineering-related needs through the application of mechanical design philosophy in engineering practice.**
Program Outcome (c) an ability to design a system, component, or process to meet desired needs
- 4. Communicate in oral and written presentations using graphic and/or visual media appropriate for an engineering business environment.**
Program Outcome (g) an ability to communicate effectively
- 5. Operate productively in individual or multidisciplinary, team-oriented projects.**
Program Outcome (d) an ability to function on multi-disciplinary teams
- 6. Be exposed to modern developments, products and tools as they relate to engineering practice.**
Program Outcome (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- 7. Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards.**
Program Outcome (f) an understanding of professional and ethical responsibility
- 8. Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts.**
Program Outcome (h) the broad education, an ability to understand the impact of engineering solutions in a global and societal context
Program Outcome (j) a knowledge of contemporary issues
- 9. Recognize the need for (and obtain the tools necessary to engage in) life-long learning.**
Program Outcome (i) a recognition of the need for, and an ability to engage in life-long learning

Table I-E2 Joint ME Program Courses vs. Program Educational Objectives and Program Outcomes

		Program Educational Objectives									Program Outcomes											
		1	2	3	4	5	6	7	8	9	a	b	c	d	e	f	g	h	i	j	k	
JME	1414	Introduction to Design		x	x	x	x	x		x			x	x	x			x		x		x
JME	2410	Mechanics of Deformable Bodies	x		x			x	x	x	x		x	x			x	x		x	x	x
JME	3200	Thermodynamics	x				x	x		x			x			x	x			x		x
JME	3210	Energetics	x	x	x		x	x	x	x		x		x	x	x			x	x	x	x
JME	3221	Machine Design	x	x	x	x	x	x			x		x	x	x	x		x				x
JME	3250	Materials Science	x	x	x		x	x			x		x	x	x	x				x		x
JME	3611	Materials Engineering	x		x	x	x	x	x	x			x		x	x	x	x		x		x
JME	3700	Introduction to Fluid Mechanics	x			x	x	x	x	x			x			x	x	x	x			x
JME	3710	Principles of Heat Transfer	x			x	x	x	x	x			x			x	x	x	x			x
JME	3721	Fluid Mechanics Laboratory	x	x		x	x	x					x	x			x					x
JME	3722	Heat Transfer Laboratory	x	x		x	x	x	x	x			x	x			x	x	x			x
JME	4040	Senior Design Project	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
JME	4041	Senior Design Topics	x	x	x	x		x					x	x	x		x					x
JME	4170	Dyn. Res. of Physical Systems	x	x	x	x	x	x	x	x			x	x	x	x	x	x				x
JME	4180	Dyn. Res. of Physical Systems (Lab)	x	x	x	x	x	x	x	x			x	x	x	x	x	x				x
JME	4250	Materials Selection in Eng. Design	x	x	x	x		x		x	x		x	x	x		x		x	x	x	x
JME	4310	Control Systems I	x		x	x		x			x		x			x			x			x
JME	4800	Building Env. System Parameters	x		x	x		x	x	x	x		x		x	x	x	x				x
JME	4810	Air-Cond. Systems & Equipment I	x		x	x	x	x	x	x			x		x	x	x	x				x
JME	4820	Air-Cond. Systems & Equipment II	x		x	x	x	x	x	x			x		x	x	x	x				x

Table I-E3
JME 141 Deformable Bodies Weekly course material vs. Joint ME Program Educational Objectives

Course Material		#1	#3	#6	#7	#8	#9
Week 1	Introduction	Axial, shear bearing			Factors of safety		Design & Analysis
Week 2	Superposition	Hooke's law					
Week 3		Shearing stress/strain	Saint-Venant				Stress concentration
Week 4	Statically indeterm.	Torsion: Circular shafts				Presentation	
Week 5		Torsion: Noncircular					Transmission shafts
Week 6	Bending composite section	Pure bending	Stress concentration			Presentation	
Week 7	Eccentric axial loading	Unsymmetric bending	Transverse shear				
Week 8			Mid-term exam and spring break				
Week 9		Thin-wall members	Shear in longitudinal cut				
Week 10	Combined loading	Shear center					Principal stresses
Week 11		Mohr's circle				Presentation	Yield, Fracture criteria
Week 12	Shear/bending diagrams	Relations: w/V/M	Thin walled vessels	Pressure vessels			
Week 13		Deflection of beams		Standard sections			Design of beams
Week 14	Statically indeterminate beams	Plastic deformation					
Week 15		Buckling of columns				Presentation	Design of columns

APPENDIX I – F

Student Advisory Board Evaluations, Student Course Evaluations

QUESTIONS FOR STUDENT ADVISORY COMMITTEE

1. Please comment on the quality of the required engineering courses you take outside of Mechanical Engineering:
EE 280, 250, 290, etc.; CS 265
2. Comment on the value of your undergraduate lab experiences.
 - a. Did the labs correspond to what you were doing (or had done) in class?
 - b. Did you get to have hands-on experience?
 - c. Where the experiments clear to you as to what you were learning?
 - d. Where the time requirements for labs and lab reports adequate, too much. etc?
3. Is there any noticeable difference in the quality of instruction between our full-time and affiliate faculty that you have had in courses? Are professors or TA's available when you need help?
4. Do you feel that there is any significant amount of academic dishonesty going on in exams or take-home assignments/ Is the honor code well understood?
5. Do you feel that prerequisite courses provide you with the knowledge you need to go on to the next course, or do you sometimes feel lost when you enter a new semester?
6. How do you feel the over-all work load is in the Junior and Senior years? Is it manageable, do you feel under undue stress?

Please answer in writing, but it can be anonymously, if desired.

David A. Peters

QUESTIONS FOR STUDENT ADVISORY COMMITTEE

1. Please comment on the quality of the required engineering courses you take outside of Mechanical Engineering:

EE 280, 250, 290, etc.

I've only taken EE280 so far. The class was reasonably well run, all things considered, but it does cover lots of material.

CS 265

I'm taking CS 101/102 instead of CS 265. CS 101 is an excellently run class, and I have found it quite interesting. I'm taking 101/102 because I feel that knowing how to program well will be extremely important. I'm not sure that the CS taught in 265 will be enough in a world that is increasingly dependant on computers.

2. Comment on the value of your undergraduate lab experiences.

a. Did the labs correspond to what you were doing (or had done) in class?

Yes, for the most part all the labs I have had related well to the class.

b. Did you get to have hands-on experience?

In some labs more than others. In ME/ChE 325 the labs are actually more demonstrations than labs, so we really don't do very much hands on work. The TAs do most of the lab, which makes writing up lab reports difficult (in the sense that it is difficult to write a lab report when there was no experiment).

c. Were the experiments clear to you as to what you were learning?

Yes, most labs have had clearly stated educational objectives.

d. Were the time requirements for labs and lab reports adequate, too much, etc?

Time requirements have been set appropriately.

3. Is there any noticeable difference in the quality of instruction between our full-time and affiliate faculty that you have had in courses? Are professors or TA's available when you need help?

The affiliate faculty have been, in my experience, as good as the full-time faculty. TAs particularly seem to have trouble making special help sessions outside of normal office hours.

4. Do you feel that there is any significant amount of academic dishonesty going on in exams or take-home assignments? Is the honor code well understood?

I don't think I have ever heard anybody talk about cheating on an exam. That seems to be taken very seriously. I think there is some cheating/copying on homework, but that this represents a fairly minor percentage of the students. Most classes minimize the value of homework, and this makes it not-worthwhile for students to cheat.

5. Do you feel that prerequisite courses provide you with the knowledge you need to go on to the next course, or do you sometimes feel lost when you enter a new semester?

Prerequisites, so far, have prepared me well, and classes usually start slowly so that everyone can get caught up.

6. How do you feel the over-all work load is in the Junior and Senior years? Is it manageable, do you feel under undue stress?

Being that this is only my second year, I really can't comment.

Please answer in writing, but it can be anonymously, if desired.

David A. Peters

QUESTIONS FOR STUDENT ADVISORY COMMITTEE

1. Please comment on the quality of the required engineering courses you take outside of Mechanical Engineering:

EE280 was not a bad course, though it would have helped if there were more people willing to tutor the subject or if the TA could speak better English. EE250 would be much more effective if it were taken in consecutive order with 280, since so much can be lost in the 2 years in between classes. Also, I do not believe it is fair for 250 to include a section on digital circuits if it is not covered in 280. This subject matter is covered in other EE courses, but it leaves us completely unprepared as ME students. CS265 was a beneficial course, although I was one of the few to learn Fortran77 before it was determined to be an outdated language. More than anything, it taught me how to reason through the thought process instead of simply applying a formula to solve a problem.

2. Comment on the value of your undergraduate lab experiences.
 - a. Did the labs correspond to what you were doing (or had done) in class? **Yes**
 - b. Did you get to have hands-on experience? **Yes**
 - c. Were the experiments clear to you as to what you were learning? **Yes**
 - d. Were the time requirements for labs and lab reports adequate, too much? Etc?
The 1-credit labs were definitely more work than that. When one considers the time spent working on lab reports along with time spent in lab, I was almost putting as much time into these labs as I was my regular 3 credit classes. The only lab that did not go overboard was the Heat Transfer lab, simply because we did not have to do full lab reports.
3. Is there any noticeable difference in the quality of instruction between our full-time and affiliate faculty that you have had in courses? Are professors or TA's available when you need help?
There are a few professors that I can say yes, there is a noticeable difference between full-time and affiliate faculty. As far as availability, I have not had any problems trying to get together with professors or TA's.
4. Do you feel that there is any significant amount of academic dishonesty going on in exams or take-home assignments? Is the honor code well understood?
Many times when the same book is used for a course, the same homework problems are used as well. I think that it would benefit the students more if these problems were changed from year to year. There are a lot of *backfiles* floating around from previous years that help students on homework and hinders test performance because they were not challenged on the homework sets to think for themselves.

ME394
(T17 394-01)

Organization and Grading of Course

Please answer each question by circling YES or NO. (If a question does not apply to you, leave it blank)

- 1. Course requirements clearly communicated? Yes No
- 2. Course lived up to its description? Yes No
- 3. Understood grading procedure at outset? Yes No
- 4. Your grades accurately reflect understanding of the material? Yes No
- 5. Exams covered what you expected? Yes No NA
- 6. Comments on written work sufficient/useful? Yes No

7. Please give an overall rating for the Organization and Grading for this Course. (1 to 9)

<u>Poor</u>					<u>Average</u>				<u>Excellent</u>
1	2	3	4	5	6	7	8	9	

Course Content

Please answer each question by circling (Y)ES or (N)O. (If a question does not apply to you, leave it blank)

- 8. Work load for this course was appropriate? Yes No
- 9. Were you positively challenged to live up to your potential? Y N
- 10. Reasonable time to complete assignments? Yes No
- 11. You found this course beneficial? Yes No
- 12. Combined "real world" applications with course material? Yes No
- 13. Overall did you spend more time on this class than others? Y N

14. Please give an overall rating for the Course Content. (1 to 9)

<u>Poor</u>					<u>Average</u>				<u>Excellent</u>
1	2	3	4	5	6	7	8	9	

Teaching

Please answer each question by circling YES or NO. (If a question does not apply to you, leave it blank)

- 15. Instructor is concerned for students? Yes No
- 16. Instructor is enthusiastic about course? Yes No
- 17. Instructor demonstrated expertise in course material? Yes No
- 18. Instructor made the course interesting? Yes No
- 19. The TA for this course was effective? Yes No
- 20. Lecture was organized and easy to follow? Yes No
- 21. Professor generally available for questions? Yes No
- 22. Homework/Tests were returned promptly? Yes No

23. Please give an overall rating for the Quality of Teaching for this Instructor. (1 to 9)

<u>Poor</u>					<u>Average</u>				<u>Excellent</u>
1	2	3	4	5	6	7	8	9	

Overall Course Evaluation

Please rate your Overall Satisfaction with the course. (1 to 9)

<u>Poor</u>					<u>Average</u>				<u>Excellent</u>
1	2	3	4	5	6	7	8	9	

25. What do you expect your grade will be in this course? A B C D F P 277

COURSE EVALUATION FORM

1. What did you like most about this course and professor?

ENTHUSIASTIC PROFESSOR

2. How could this course and professor improve?

LESS FORMAL WRITE-UPS

3. What would you tell another student who asked you to describe this course?

LONG WRITE-UPS FOR A 1-HOUR LAB

4. Was the text useful? Was it understandable? Why or why not?

NO

5. Were the assigned homework or problem sets helpful and relevant to the course? Why or why not?

TOO LONG

6. Please use this space to comment on any other aspect of the course. (i.e. help sessions, teaching assistants, etc.)

Supplemental Questions – Fall 2000

Course JME394
(T1739401)

In the questions that follow, the numerical scoring is: 1 (disagree) through 10 (agree).

1. Does this course include an experimental component (e.g., a laboratory experience)? Yes No

2. If yes, please rate the experience:
 - (a) Did the experience improve your understanding of the course material? 1 2 3 4 5 6 7 8 9 10

 - (b) Did you understand what was expected of you in the experiment (i.e., procedures, techniques, data analysis, etc.)? 1 2 3 4 5 6 7 8 9 10

 - (c) Does the course contribute to your ability to devise experimental procedures aimed at meeting specific objectives? 1 2 3 4 5 6 7 8 9 10

3. Does this course require working within a group or team? Yes No

4. If yes, please rate the experience:
 - (a) Were the contributions of the individual team members well managed by the team? 1 2 3 4 5 6 7 8 9 10

 - (b) Does the instructor support the team organizational activities with adequate help in developing management skills and/or advice to team members? 1 2 3 4 5 6 7 8 9 10

 - (c) Did you personally have the opportunity to take a leadership role? 1 2 3 4 5 6 7 8 9 10

5. Does this course have explicit content that deals with the professional and ethical responsibilities of engineers? Yes No

6. Independent of your response to question 5, does this course contribute to your knowledge and understanding of professional and ethical responsibilities? 1 2 3 4 5 6 7 8 9 10

7. Does this course contribute to your ability to communicate more effectively in written or oral form? 1 2 3 4 5 6 7 8 9 10

8. Are you interested in learning more about the subject matter of this course in the future? 1 2 3 4 5 6 7 8 9 10

Minutes of Undergraduate Advisory Board
Washington University Dept. of Mechanical Engineering
November 16, 2001

Attendees:

David Peters, Chairman
Richard Gardner, Assistant Chairman
Ken Jerina, Professor
Kurt Admundson
Joel Pelley
Wendy Shefelbine

In this meeting we discussed the Goals and Objectives of the Department. This committee had already given us input as to these a year earlier, but at this meeting they re-evaluated them and discussed how well we were meeting them. We discussed the various changes to curriculum that we had made based on their inputs of a year earlier. They suggested that more industry-based projects be put into the senior design course. In general, they said the faculty were doing a good job in design.

In terms of other courses, they suggested that we find a way to use CAD and programming skills throughout the four years so that they did not lose the skill between the freshman and junior years. They suggested that we needed a wider variety of senior electives, including aerospace electives. Based on this, we decided to introduce an aerospace minor with accompanying courses.

The students reiterated a concern from last year, the EE electives. As EE is now completely revamping the courses they offer as service to other departments, this will be an important topic. They also expressed concern over Math 217, Differential Equations. A committee is now formed to look into improving that course.

In terms of alumni constituents, they thought that we should encourage our placement service to do a better job of getting companies from around the country to come to campus, not just those from the Midwest. They suggested that we give them an alumni list in different states that they could contact about companies in their geographic areas.

Summary of Evaluations for tenure-track and other faculty. 2003

Shen, thermo, excellent evaluations. Should give more real-world examples, use same text as for Energetics and make transition seamless.

Chen, fluids, tremendous improvement over last year!! Excellent job of feedback working.

Okamoto and Swarwout, Senior Design, good faculty reviews but students think grading is not consistent between day-school version and UMSL version. We need to do some work here.

Hakkinen, graduate Fluids, students bifurcate on opinions. Professor also complained that half of students not really prepared. We need to re-evaluate the entire fluids sequence and how our students are prepared.

MEETING OF WUME UNDERGRADUATE ADVISORY BOARD

Whittemore House

April 30, 2003

Attendees

Georg Pingen	Scott Skeen	Taylor Cohen
Rachel Pederson	Megan Sherdan	Ariel Chatman
Gretchen Meyer	David Peters	Phil Bayly
Dick Gardner		

Comments

Finals should be spread out more.

Student services:

- Mainly just pass out resumes
- Are good around St. Louis but not around country
- Don't help in a personal way. Just say "Go to web site."
- Very few companies actually show up at job fairs
- Should also help find grad schools

Statics is good. Kevin Truman does a great job.

EE280 is not that beneficial.

EE290 is a lot of work and interesting but does not really prepare for ME jobs

Maybe we don't need a second ME course

Would like a course with more things that ME's need like MEMS, motors, etc.

Probability and Statistics – Is never used again in curriculum.

Only see simple textbook data, no real data.

ME325 ME section OK but Ch.E. section does not coordinate labs and lecture.

ME320-321. Needs to be more coordination between courses. It would help to have

Same textbook for both courses.

ME 201 Good course but heavy on space and light on aero

UMSL/Part-time students sometime lower standards.

UMSI section often has different grading standards than WU section

e.g., day/night sections of ME 404P

Need more machine design in curriculum. New ME only dedicates two weeks to it.

CS 265 -- no uniformity among sections, material not used for a long time later

List of Spring offerings should be placed in Fall Catalogue, and vice versa

EP 310

Perhaps could have more presentation, less writing

Needs component of Journal papers and thesis writing
Does not account for students with good writing backgrounds (3/2)

EN120 Unnecessary if you know what you want to do

Could use a bio-engineering elective that ME's could take (not 590V!)

Fluids Lab

Lab notebook superfluous
Equipment outdated, data usually bad
Some students make up data
Need a way to check validity of data while taking it!

MEMS courses

CAD lab should be upgraded (stress-check, word, excel) and make open to public

Machine shop is great.

Need good display case on third-floor landing

Minutes of the Meeting of the ME/AE Student Advisory Board

March 23, 2004

Attendees:

Stephen Forbes, Colin Lindsey, Anita Askman, Sarah Springer,
Aaron Ferber, John Keplinger, Steven Floyd, Scott Kaminski,
Michael Thomas, Phillip parish

Faculty:

David Peters, Dick Gardner, Ken Jerina, Rich Axelbaum

- 1.) Students indicated that they would like more MATLAB training and then have MATLAB utilized more in their upper-level courses. In response, we have instituted a new course, ME 265, which teaches MATLAB, and we are putting MATLAB problems in our homework sets.
- 2.) Students said they would like more Machine Shop experience. In response, we will set up Machine Shop tutorials in our senior design course about the 5th week so that students can use the experience in making prototypes.
- 3.) Students also indicated that they thought the preliminary design phase of the capstone design course was too long. We will pass this information on the capstone design faculty for their responses.
- 4.) There was some indication that Pro-E was showing up as a requirement in several job openings they had seen. We will talk this over with our Industrial Advisory Board to see if there is a shift in industry needs for Pro-E versus Autocad.
- 5.) We discovered from the students that it was difficult to put all of the courses in proper sequence for the robotics minor. We will henceforth tell robotic minors that they should have controls but not necessarily dynamic response before taking the introductory robotics course.
- 6.) It looks like we are doing a good job in our Physics and Math courses and in our EE electives. However, students would rather have a purely engineering chemistry course, rather than the sequence from Chemistry. It is not possible for us to usurp Chemistry's role here, but we will feed back to them the information that our students would like more engineering examples to go along with the biological examples in the sequence.
- 7.) There is a big problem with Arts and Sciences giving evening exams for daytime courses. These exams conflict with regularly scheduled ME courses. Students complained that they missed several important lectures. Physics, Chemistry, Biology, and Mathematics all have this policy.

UMSTL ME SAB 04
Minutes

The student advisory committee met on April 7, 2004. Those in attendance were:

Students:

Brett Novotny
Will Winters
Will Danne
Vadim Protason

Faculty:

David Peters
Dick Gardner

Students said the schedule made it difficult to schedule more than two classes at a time. Originally, this was set up as a part-time program so that we did not envision students taking more than one or two courses. All of courses are set up in the evenings to accommodate the part-time student. There are only four evening class slots available. So, there can be conflicts. The students said that they would be willing to have Friday evening classes if that would open up another time slot.

Students brought to our attention that not all professors are obeying the rule to start classes 7 minutes after the hour to allow time for students to arrive from other classes.. We will send a memo to all instructors reminding them of this.

Students, in general, were very pleased with the quality of faculty and of the courses. They did say that they thought we needed a course in MATLAB. We have already implemented this in our day-school program and will be able to transfer it to the UMSTL program if it goes well there.

We learned from the students that the Machine Design Course, when taught in summer, was not getting the full number of hours that it should per week. We will correct that next summer.

Students expressed an interest in having more access to the TA's including the possibility of more help sessions before or after class.

A meeting of the ME undergraduate advisory board was held on Friday, September 24, 2004. Those in attendance were:

Students

Stephen Forbes	Colin Lindsey	Scott Kaminski	Adam Nathan
Megan Sheridan	Erin O'Shea	Ryan Demien	James Eckstein
Elizabeth Henderson	John Keplinger		

Faculty

David Peters	Richard Gardner	Ken Jerina	Michale Swartwout
Amy Shen	Rich Axelbaum	Mark Jakiela	

Some of the major ideas which surfaced from this meeting were:

We could use courses in turbomachinery and IC Engines

Machine Design is too condensed and needs more time to digest

There is a disconnect between Fluids and Heat Transfer and their labs,
Which occur the following semester.

The TA's in vibration do not allow the students to do enough "hands on" work.

Design notebooks in 371 are a very good idea.

EP 310 has some sections where the teachers are afraid of numbers.

MEETING OF UNDERGRADUATE ADVISORY BOARD

Tuesday, March 1, 2005

Attendees: Jim Jost, Leah Pike, Ariel Chatman, Joseph Lieb, Rachel Pedersen, Liz Henderson, Scott Kaminski, James Eckstein, Adam Nathan, Megan Sheridan, Robby Humble, Colin Lindsey, Steven Floyd

1. Students expressed concern over the rise of large classes over the past year. Classes have gone from 30 to 55. We will see if we can add some more sections for the Fall or else come up with some way to give more one-on-one instructor time.
2. ME 265 is doing a great job of introducing students to MATLAB. The advisory committee recommends we make it mandatory. We are going to do this and offer it every semester.
3. It would be good to have a unifying software, like Labview, for all of our laboratory courses. We have sent this recommendation to our systems manager for review.
4. Would it be possible to introduce Pro-E instead of solid edge. We have asked our CAD faculty to study this possibility.
5. Some applications of CAD should be available between the freshman and senior years. Perhaps Machine Design could utilize a required drawing. Our design faculty will study this possibility.
6. Make sure that help sessions have assigned rooms and not just the graduate student study space. This we will implement immediately.
7. Homework grading needs to take into account back files as well as the possibility of online access to solution manuals.
8. We need a better textbook for Aero-Propulsion. We will choose a different book next year.

Student Advisory Board Meeting
October 28, 2005

The Student Advisory Board for the Mechanical Engineering Program met in Jolley 306 at 1:00 PM on October 28, 2005.

Present were: Profs. Richard Gardner and Kenneth Jerina and students Adam Nathan, Adam Hansen, Leah Pike, Jim Jost, Joe Lieb, Megan Sheridan, Ariel Chatman, James Eckstein, Patrick Mc Carthy, Min-Sun Son, Graham Walker, Brandon Morgan, Peter Shaw, Kathleen DiSanto and Steve Reis.

Various courses in the Mechanical Engineering Program were discussed.

Thermodynamics, ME 320: The two sections are using a different approach this year which has put emphasis on mathematical derivations rather than physical understanding of the materials and the first and second law from notes developed by the instructors. So far the textbook has not been used and the TAs have not been a help. Recent interdiction by Dr. Peters seems to have helped to redirect the course back on track but the students would like to meet again with the Chair to discuss the course at the end of the semester.

The EE sequence, ESE 230 + ESE elective, was discussed. The students liked the practical lab aspects of ESE 102 but were disappointed that OP-AMPs were no longer part of the course. The course has been passed on from the originator to another instructor who appears to be going through the motion of following the first instructor's notes without much enthusiasm. A better text could be found.

It was suggested that SEAS create a MATLAB reference desk where students could get MATLAB help for any course. This might be implemented in ME with office hours with the graders for ME 265, Mechanical Engineering Computing.

The design sequence was discussed at length. The students want more guidance in learning the design process. It was suggested that they be given a serious case study of a design project in one of the courses before ME 404P. ME 322A needs more analysis of machine parts, fewer overhead "point at the picture" presentations. The students indicated that they hand in a lot of small "deliverables" during the semester but still do not have an idea of how they are doing in the course. Perhaps mid-term grades should be given.

ME 433 needs a better text. The course has a lot of details but the students appear to be confused as to how control systems actually work. More applications are being asked for.

The students requested open lab time in Jolley 110 in connection with 404P. Some students who got into the lab were asked to leave because there was no lab monitor.

Problems of academic integrity were brought up. The students would like the individual instructors to make up their own problems for the courses so that they would know what would be on the exams.

The meeting was adjourned at 1:30 PM.

Washington University
Department of Mechanical & Aerospace Engineering
Aerospace Engineering Student Advisory Board
Minutes

Meeting of Monday, 19 December 2005

The meeting was called to order at 11:10 am.

Attendance: Professors Agarwal, Gardner, and Swartwout [Swartwout recording], and the Student Advisory Board, consisting of:

Mark Ambrosi (BSAE/MSAE 2006)
Brian Bauer (BSAE/MSAE 2005)
Ben Hamlington (BSAE/MSAE 2006)
Elisabeth Rennell (BSAE 2008)
Justin Char (BSAE 2008)
Forrest Rogers-Marcovitz (BSAE 2008)
Stephen Forbes (MSAE 2006)

- I. **Introduction** – Professors Swartwout and Agarwal convened the meeting and outlined the objectives. The rest of the meeting consisted of Professors and students asking questions and a discussion that followed. These topics are summarized, below.

- II. **Recruitment/Advising** – The students expressed concerns with the way that incoming AE students are recruited and/or advised. They feel that freshman-level AE advising is woefully inadequate, both in terms of the information available and the lack of 1-to-1 faculty advising. **ACTION: At least one AE faculty will attend the “mass meeting” of ME/AE frosh advisees hosted by Professors Genin & Fried each semester. ACTION: Professor Swartwout will incorporate AE advising information into his MAE190 and MAE201 classes (since those classes are the biggest gateways to 1st/2nd year AE students).**
 - a. At present, the only AE freshman advising that takes place is peer-to-peer via EN120 (Freshman Seminar). The students suggested that faculty do not increase participation in EN120, given that no other department participates in such a matter.

 - b. This topic came up again regarding the MAE Department’s weekly graduate seminars; few of the undergraduates were aware that they existed. **ACTION: Future AE notices such as advising/majors, seminars, special presentations and events should be posted in more public places, such as the CEC boards and near the student pendaflexes.**

- III. **Balance between Aircraft, Spacecraft, Coursework and Design** – Professor Swartwout admitted that his own research interests (hands-on spacecraft design) strongly influence the design experience of AE students, given that he is the sole instructor for all of the AE design courses (MAE190, MAE201, MAE301, MAE404P). Therefore, he asked how students viewed the balance between spacecraft and aircraft projects, and the balance between coursework and hands-on projects:

- a. Students were greatly interested in seeing more aircraft design activities. They recognized that doing so would require additional AE faculty specializing in aircraft design (something the faculty would like to see as well!).
- b. Some students expressed concerns that our AE degree is almost entirely focused on spacecraft, but the other students explained that the first-year courses (MAE190 and MAE201) are spacecraft-heavy, while the upper-level courses are almost entirely focused on aircraft. [This misconception is indicative of our lack of early AE advising!]

IV. Comments on Specific Courses

- a. MAE141D (Introduction to Engineering Design: Project). The students are extremely frustrated with the current course, both with the early labs and the final contest. Others noted that one purpose of the course is to familiarize students with basic principles of dynamics, statics and design – something that many, if not all, students now receive in their high school physics courses. Students also suggested that an aerospace section be created, using RC aircraft in the design competition.
- b. MAE190 (Special Topics in Aircraft/Spacecraft Engineering - formerly EN190). Noting that all of the students present had participated in at least one semester of EN190, Professor Swartwout asked whether MAE190 should become a required course, thereby formally connecting all AE students with one another and hands-on project design. The students were uniformly against the idea. Instead, some suggested creating a 2-credit version for those who wanted to spend more time and/or mentor others. Students also pointed out that the course catalog is misleading, as it suggests that aircraft projects are included in the course. Professor Swartwout explained that the course catalog information was correct when it was published, but that the publishing cycle is about a year ahead of real time, meaning it might be a year before the corrections make it into print. The students agreed that advance notice (via WebFAC email) about the lack of aircraft projects is the best solution, given the situation.
- c. MAE488A (Aerospace Propulsion). Students identified a possible discrepancy: for AE majors, MAE488A replaces the ME energetics course (MAE321). But, in previous semesters, MAE321 was listed as prerequisite for MAE488A! Dr. Gardner explained that the current instructor (Dyer) has changed the course since he offered it last year to remove the dependency on 321. **ACTION: Review the status of MAE488A at the next Board meeting.**
- d. ESE230 (Introduction to Electrical Networks). The students expressed very deep dissatisfaction with all three sections of the current course; they do not feel they are learning anything in class and they recognize that this course is their only opportunity to acquire fundamental knowledge of electrical circuits. **ACTION: The Board, including faculty, will ask the MAE department chair to alert the incoming ESE chair about this deficiency.**

V. Computing

- a. MAE265 vs. CSE200. Students expressed a range of opinions on the level of computing training required, and whether that could be achieved in our MAE265 class alone. However, given that none of the students present had taken our

MAE265 class (some Board members are enrolled for next semester's course), it was agreed to table the discussion until Spring.

- b. CAD. Some students expressed concerns about our Solid Edge CAD software, fearing they would be at a competitive disadvantage compared to students who were taught Pro/E or other, more widely-used packages. However, other students who have spent time in industry assured them that the fundamentals of design and 3D modeling learned in Solid Edge would be sufficient.
- c. CFD. A question was raised about making a "standard" CFD package available in the CEC and/or MAE380 (Aerodynamics). Professor Agarwal deferred on the former, citing the complexity of even "standard" packages. However, he agreed that there could be a place for introducing CFD software in MAE380, in the same way that a Finite Element Analysis package (StressCheck) is introduced in the last week of MAE489 (Aerospace Structures).

VI. Adjourn – The meeting was adjourned at 12:35pm; next meeting will be scheduled for **April 2006**.

Respectfully Submitted,

Michael Swartwout

A meeting of the Mechanical Engineering Undergraduate Advisory Board was held on Friday, February 24, from 12:00 to 1:00 p.m. in Jolley 306. The attendees were:

Faculty: David Peters, Dick Gardner, Ken Jerina

Students: Zack Weber, Daniel Cohen, Melissa Holtmeyer, Topher McFarland, Matt Fishman, Jake Sparks, Joe Nelson, Roger Rowe, Parrick McCarthy, Adam Hansen, Graham Walker, Joseph Lieb, Daniel Fishbone, Leah Pike, Peter Shaw, Kathleen Disanto, Megan Sheridan, Ariel Chatman, Robby Humble, Natalie Zaczek, Adam Nathan.

The following were the major items of discussion.

1. The new ME Automatic Controls Course, "Aircraft Stability and Controls" is very good. The Department made major changes in the course last year after student feedback, and the results have been very positive. One student who started last year, dropped the course, and then took it this year was especially impressed. The new textbook was also deemed to be a big improvement.
2. Our new MATLAB Course, ME 265, was also given very high marks. The students are now able to jump right in to the other courses with computing expertise. The student committee recommend that this become a required course, and we will follow up on that recommendation. The students also said that the MATLAB skills were carried through into other courses and that Heat Transfer, Dynamic Response, Fluids, and Controls all had the students utilize their MATLAB skills. This is what we proposed in the beginning.
3. We have a large number of Dual-Degree Students in our program (about 25%) and they had some specific input about how they transition into our program. First, they said that many of them already have our advanced Engineering Math course, ESE 317 as part of other physics courses; and they would not take it over. They would like a chance to proficiency out of whatever parts they don't know. On the other hand, other students felt it was a good review. This course is an Engineering-wide requirement, so we could not arbitrarily exempt students from it. However, they can go to the professor, Dr. Katz, and take a proficiency exam. Not all of them knew this, so we will instruct advisors to make this more clear. Starting next Fall, Prof. Jerina will be advisor to all dual-degree students. Since he was at this meeting, it seems clear that this will happen.

The Dual-Degree students also mentioned that Materials is not really a pre-requisite to Machine Design, although the instructor seemed to give them that impression. We were able to discover that this was just a communications glitch. Mechanics of Deformable Bodies is a prerequisite, but not Material Science. The students all have Deformable Bodies before beginning Machine Design, and that is what the Professor was alluding to.

3. Students said that they would like to see more Machine Design in the curriculum. Presently, we have 4-unit Introduction to Design that contains both machine design and concepts of patent search and design process. They suggested moving the Patent Search into the Freshman Design Course and thus allowing more Machine Design in the Junior course. We will discuss this in our curriculum review meeting.
4. Students, once again, asked about PRO-E software. As it turns out, we have purchased licenses for this due to our feedback from last year, but we have not yet

integrated it into the curriculum. There will be a follow-up task on this given to the design committee.

5. Two years ago, we made a major improvement in Thermodynamics in the way it is taught. However, last Fall, we tried an experimental approach that was a disaster. The Board told us that the follow-on courses (Energetics and Propulsion) are indeed making adjustments for the fact the class in those courses now did not have a proper background. We follow up this action item by meetings with the Thermo faculty to make sure that next semester goes back to a proper Thermodynamics preparation for the other courses.

2/27/06

Many students in Fundamentals of Heat Transfer with Professor Gardner are frustrated with his method of teaching. It seems as if 20 minutes of each 1 hour class period are spent talking about topics that aren't related to class material, or even engineering in general. This makes completing the homework and tests extremely difficult due to a lack of understanding of the material. The students would prefer if class time was better spent by doing examples, etc.

In addition, not having the homework be mandatory is detrimental to students because there is very little incentive to actually do it. I understand that Professor Gardner is afraid that student will obtain answer keys and not actually spend the time working out the solutions, but the percentage of students who do this is small compared to the amount of students in the class. It is beneficial for the students to do the homework, but if it does not count towards the final grade, most students will not do it. Even if the homework was a very small percentage of the final grade, it is highly likely that the majority of students in the class will complete the homework each week and therefore understand the material better.

Thank you.

APPENDIX I – G

Assessment Feedback

1.) External Advisory Boards

NATIONAL COUNCIL ROSTER OF MEMBERS
Washington University in St. Louis
School of Engineering & Applied Science
June 13, 2006

Mr. Stephen F. Brauer (Chair)
CEO
Hunter Engineering Company

Dr. Allen R. Atkins
Executive General Manager (Retired)
Technology Acquisition & Univ. Relations
The Boeing Company

Mr. Jack Bodine
Executive Vice President (Retired)
Bodine Aluminum

Mr. Jerome F. Brasch
President
Brasch Manufacturing Company

Mr. Charles A. Buescher, Jr.
Executive Vice President (Retired)
Continental Water Company

Dr. Santanu Das
President, CEO/Chairman of the Board
TranSwitch Corporation

Mr. Carl J. Deutsch
Chairman (Emeritus)
Standard Machine & Mfg. Company

Mr. Arnold Donald
President & CEO
Juvenile Diabetes Research Foundation

Mr. Harold F. Faught
Senior Vice President (Retired)
Emerson Electric Company

Mr. Norman Foster
President (Retired),
Chemical Waste Div.
Philip Environmental Inc.

Mr. Rudolph Freedman
Chairman (Retired)
SEMCOR

Mr. Donald A. Jubel
President
Spartan Light Metal Products

Mr. Dennis Kessler
President
Kessler Management Consulting

Dr. David Kipnis
Department of Medicine
Washington University

Dr. Harold Y. H. Law
President (Retired)
Chinese American Forum

Mr. Charles Lebens
President
Lebens Associates, Inc

Dr. Ellen Liaw Lee
President
Lee Incorporated

Mr. John F. McDonnell
Chairman of the Board (Retired)
McDonnell Douglas Corporation

Mr. Joseph R. Moyer
President (Retired)
Charles S. Lewis & Company

Dr. Jai Nagarkatti
President/CEO
Sigma-Aldrich Corporation

Ms. Brenda Newberry
President/CEO
The Newberry Group

Mr. Frederick (Rick) J. Oertli
CEO
Guarantee Electric

Dr. Richard E. Pinckert
Director, Environmental Assurance
The Boeing Company

Dr. Stanley I. Proctor
President
Proctor Consulting Services

Mr. Gary L. Rainwater
Chairman, President and CEO
Ameren Corporation

Mr. Richard Roloff
Executive Vice Chancellor
Washington University

Dr. Donald K. Ross
Chairman
Ross & Baruzzini

Dr. Henry G. Schwartz, Jr.
Chairman (Retired)
Jacobs/Sverdrup Corp.

Mr. Gregory A. Sullivan
CEO
Global Velocity

Dr. William K. Y. Tao
Chairman/CEO (Retired)
William Tao & Associates

Dr. Susan M. Welsh
President
Linguagen Corporation

Mr. James A. Young
Vice President- Engineering
Naval Systems/St. Louis Site, Integrated Defense Systems
The Boeing Company

SCHOOL OF ENGINEERING AND APPLIED SCIENCE NATIONAL COUNCIL MEETING

APRIL 19, 2001

8:00 A.M. - 12:00 P.M. IN SEVER HALL, ROOM 300

REVISED AGENDA

- 7:30 - 8:00 CONTINENTAL BREAKFAST
- 8:00 - 8:05 WELCOME AND CALL TO ORDER
William K.Y. Tao, Council Chair
- 8:05 - 8:20 CHANCELLOR'S REPORT
Mark S. Wrighton, Chancellor
- 8:20 - 8:45 DEAN'S REPORT
Christopher I. Byrnes, Dean, The Edward H. and Florence G. Skinner Professor
- 8:45 - 8:50 CAMPAIGN UPDATE
Stephen F. Brauer, Campaign Chair
- 8:50 - 9:00 COUNCIL DISCUSSION
- 9:00 - 11:25 New initiative directions from the strategic planning retreats
(15 minute presentations with 5 minutes discussion on each area)
- 9:00 - 9:20 Environmental Engineering
Pratim Biswas, Director, Environmental Engineering Science Program
The Stifel and Quinette Jens Professor
- 9:20 - 10:00 Computers and Communications
Barry Spielman, Chair, Department of Electrical Engineering
Catalin Roman, Chair, Department of Computer Science
Norman Katz, Chair, Department of Systems Science and Mathematics
- 10:00 - 10:10 COUNCIL DISCUSSION
- 10:10 - 10:20 BREAK
- 10:20 - 10:40 Mechanical Engineering and Aerospace
David Peters, Chair, Department of Mechanical Engineering
The McDonnell Douglas Professor
- 10:40 - 11:00 Chemical Engineering: Bioprocessing and Environmental Engineering
Milorad Dudukovic, Chair, Department of Chemical Engineering
The Laura and William Jens Professor
- 11:00 - 11:20 Intelligent Systems
Kevin Truman, Chair, Department of Civil Engineering
- 11:20 - 12:00 COUNCIL DISCUSSION AND WRAP-UP
Farewell comments from William Tao, retiring council chair
Remarks from William Patient, new council chair
- 12:00 - 1:00 LUNCHEON BUFFET (Optional)



MECHANICAL ENGINEERING AT WU
March 9, 2001

Academic Philosophy: every student will receive a broad-based ME education in every stem of Mechanical Engineering. Below are the **required** specific ME courses and labs.

<u>Subject</u>	<u>course units</u>	<u>labs</u>
1) Fluid and Thermal Sciences	18 units	2
2) Dynamics and control	17 units	1
3) Solids and Materials	11 units	2
4) Engineering Design	10 units	2

Beyond this, there are only 12 units of ME electives and two units of Engineering electives.

There are also required courses in other disciplines:

- 8 units of chemistry
- 6 units of electrical engineering (3 flexible)
- 3 units of computer science


Minors Available and (*) proposed:

- Aerospace*
- Applied Mechanics*
- Environmental
- Industrial
- Robotics

Major Research Areas:

- Aeronautics and Propulsion
- Aerosols and Combustion
- Biomechanics
- Design Methodology
- Materials and Manufacturing

October 16, 2001

TO: Profs. Peters, Bayly and Jerina
FROM: R. A. Gardner 
SUBJECT: UG Committee review of Su 2001 Joint courses.

We need to get together in the next week to review the assessments of JME 041, JME 225, JME 317-8, JME 390 and JME 325.

I have put copies of the instructor's assessments for all of the courses except JME 325 in your mailboxes. Please read over the assessments and write a one-sentence comment on each of them. I will combine the comments into the "minutes" of our meeting along with any other discussion that takes place.

Today is Tuesday, 10/16. Are you free for a meeting this Thursday at 2:30 PM? No seminar this week. Or, are you free on Monday or Tuesday 10/22 or 10/23? Let me know by email.

Thanks,

Dick

JME 041

JME041 Assessment of Objectives for Summer 2001 Course

1. **Apply fundamental scientific and engineering concepts involving Dynamics and Systems, Material Science, Mechanics and Solids and the Thermal-Fluid Sciences in order to identify, formulate and solve a variety of mechanical engineering problems.**

Assessment: N/A

2. **Design, modify, conduct and analyze experiments and experimental data in the areas of thermal-fluid sciences, solid mechanics and dynamical systems.**

Assessment: Students are developing proficiency in designing/running simple physical experiments; they are learning how to interpret our deliberately vague lab instructions and identify the parts of the instructions that require them to develop an experimentation plan. They are also more capable of answering the "whys" of how the labs are constructed and run.

3. **Directly perform system, process and component selection in order to satisfy specific engineering-related needs through the application of mechanical design philosophy in engineering practice.**

Assessment: Students "learned by doing" the selection process. A few have grasped the concept very well, performing simple experiments to verify their concept & sizing design decisions early in the contest. It might be useful to specifically ask all students to perform such tests.

However, the JME041 summer session contest projects continue to be "low performers" compared with the Joint Program students participating in the school-year sessions. The instructor has not yet determined whether it is the class timing (one, three-hour session in the evening) or something in his teaching style that is encouraging low performance. In the next class, the instructor will try to more closely engage with the students during their concept generation and development process in the hopes that he can encourage more ambitious (and effective) contest designs.

Similarly, it would be helpful to encourage/require functional testing in advance of the dry run; most students had significant difficulties with the dry run because it was the first time that they tried to meet all the contest goals at once.

4. **Communicate in oral and written presentations using graphic and/or visual media appropriate for an engineering business environment.**

Assessment: Students' concept sketches and pre-CADs were adequate but not spectacular. It might be beneficial to allow resubmissions/revisions (allowing students to

respond to feedback). The instructor will devote more time to explaining the roles and requirements of concept sketches & part drawings.

5. Operate productively in individual or multidisciplinary, team-oriented projects.

Assessment: Students worked well in teams, although there were some configurations that inevitably led to more socializing than progress. The instructors' policy of choosing the groups himself seems to be effective at reducing the social groupings.

6. Be exposed to modern developments, products and tools as they relate to engineering practice.

Assessment: Students have developed proficiency with basic shop tools and have demonstrated competency (based on the results of their contest entries). Some of the shop tools (the lathe, most notably) need to be upgraded.

7. Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards.

Assessment: N/A

8. Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts.

Assessment: N/A

9. Recognize the need for (and obtain the tools necessary to engage in) life-long learning.

Assessment: This need was not well-met in the summer session; this is because the main contribution to life-long learning is the CAD portion. Only one student took the CAD section in Summer 2001.

10. Be afforded the opportunities to participate in cooperative education, internships, research experiences or international exchange programs in order to gain experience beyond the classroom

Assessment: N/A

JME 317-318

Course Objectives JME317 & JME318 Summer 2001

1. **Apply fundamental scientific and engineering concepts involving Dynamics and Systems, Material Science, Mechanics and Solids and the Thermal-Fluid Sciences in order to identify, formulate and solve a variety of mechanical engineering problems.**

Assessment: Dynamic analyses were applied in the analysis of single-degree and multi-degree of freedom vibratory systems. Seven homework assignments were given the students that reinforced vibration/modal analysis techniques taught in the lectures. The homework was designed to reinforce concepts learned in lectures. Most of the homework problems were dynamic/vibratory analysis of basic mechanical engineering equipment/problems.

2. **Design, modify, conduct and analyze experiments and experimental data in the areas of thermal-fluid sciences, solid mechanics and dynamical systems.**

Assessment: In the JME318 Lab the students conduct 6 experiments. Four of the labs involve vibratory measurements of single and multi degree of freedom systems. The measured results are compared with analytical predicted results. Two additional labs involve the design of vibration isolation equipment.

3. **Directly perform system, process and component selection in order to satisfy specific engineering-related needs through the application of mechanical design philosophy in engineering practice.**

Assessment: This Goal is not applicable for this class.

4. **Communicate in oral and written presentations using graphic and/or visual media appropriate for an engineering business environment.**

Assessment: Each student in JME318 presented a written laboratory report for each of the six assigned laboratory experiments. Each student turned in written homework assignments for JME317.

5. **Operate productively in individual or multidisciplinary, team-oriented projects.**

Assessment: Students operated individually in their homework assignments and exams for JME317. The students were allowed to work in groups of two for JME318 with regards to submitting a laboratory report for the non-design experiments. Each student for JME318 submitted an individual laboratory report for the two design experiments. The student's productivity increased during the semester as measured by the increase in the average exam scores from 74 for the 1st exam to 81 for the 2nd exam.

- 6. Be exposed to modern developments, products and tools as they relate to engineering practice.**

Assessment: Dr. Dale M. Pitt, the instructor for this class, is a Boeing Associate Technical Fellow. Dr. Pitt discussed the vibratory/dynamics issues and challenges he was facing at work in the Boeing Phantom works. These discussions include a video presentation of F-18 wind tunnel and flight flutter testing, F-18 landing simulated "Drop Test", and F-18 dynamic weapon ejection responses. The students were required to use MATLAB® for the analysis of three homework problems. MATLAB® is a state-of-the-art analysis and plotting tool that is rapidly becoming a standard engineering industry practice.

- 7. Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards.**

Assessment: Dr. Dale M. Pitt is a registered professional engineer in the state of Missouri. Dr. Pitt, on many occasions, discussed ethical aspects of engineering as related to his primary job at the Boeing Phantom Works.

- 8. Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts.**

Assessment: This Goal is not applicable for this class.

- 9. Recognize the need for (and obtain the tools necessary to engage in) life-long learning.**

Assessment: The students were taught the need for life-long learning in the engineering profession, Dr. Pitt discussed his three recent technical papers he authored and presented at technical conferences during the last year. The need for continual learning and the process of learning was stressed throughout the semester. The students were encouraged to buy MATLAB® and learn it's use for JME317, JME318 and other engineering classes.

- 10. Be afforded the opportunities to participate in cooperative education, internships, research experiences or international exchange programs in order to gain experience beyond the classroom**

Assessment: This Goal is not applicable for this class.

Course Objectives

- 1. Apply fundamental scientific and engineering concepts involving Dynamics and Systems, Material Science, Mechanics and Solids and the Thermal-Fluid Sciences in order to identify, formulate and solve a variety of mechanical engineering problems.**

Assessment: Throughout the course we emphasize the application of fundamental scientific and engineering concepts. Materials science is presented as the interrelationship of properties, structure, and processing of materials. Lectures are divided into these three broad areas viz., properties, structure, and processing. Laboratory experiments conducted in parallel emphasize these three areas.

- In the first few lectures, we discuss the basic mechanical properties which are key to the prediction of the behavior of a component under applied static and dynamic loads and selection of materials for different applications. Tensile, compressive, fatigue, fracture toughness, and creep properties are defined, and experimental methods of determination of these properties are discussed. Students perform three experiments: (i) Tensile testing of materials, (ii) Hardness testing, and (iii) Impact testing.
- In the next series, we discuss the structure of materials at different levels viz., the individual atomic level, aggregates of atoms, microscopic, and macroscopic. The similarities and differences in the structure at each level of metals, polymers, and ceramics are discussed and related to the properties. Students perform three experiments related to the structure of materials: (i) Analysis of different crystal structures using three dimensional models made up of ping-pong balls, (ii) Crystal structure determination by x-Ray diffraction, and (iii) Study of microstructures using optical microscopy.
- In the final series of lectures, we discuss the different processing methods used to control the structure and properties of materials. After a brief introduction to the solid state diffusion and strengthening methods, the students are introduced to phase diagrams and phase transformations. The use of phase diagrams in controlling the microstructures of various metals and alloys and ceramics is discussed. The course concludes with a discussion of deformation and processing of polymers. Three experiments related to processing are: (i) Heat Treatment of Steels, (ii) Strain hardening, and (iii) Precipitation Hardening.

The ability of students to apply the fundamental materials science concepts to identify, formulate and solve a variety of mechanical engineering problems was assessed by requiring the students to complete successfully five home work assignments and three examinations. In each home work assignment, twenty problems were assigned. In all assignments, about 70-80% of the problems involved the application of fundamental concepts to solving a variety of mechanical engineering problems; the remaining 20-30% of the problems were formulated to test the understanding of concepts. In each of the three examinations, half the number of questions were testing of students' understanding of concepts, and the remaining half the number of questions were numerical calculations to test of students' ability to analyze the problems logically, use the correct formulae, and determine whether the answers were reasonable. In homework assignments, students generally scored in the range 75-100% with the mean being about 90%. There was a wider range in the examination grades; the range was typically 60-100% with a mean of 80%. After grading of each examination, the common mistakes made by students, and some key concepts to pay attention were discussed.

- 2. Design, modify, conduct and analyze experiments and experimental data in the areas of thermal-fluid sciences, solid mechanics and dynamical systems.**

Assessment: • Students conduct a total of nine experiments. In each of these experiments, students have to select appropriate test parameters (such as temperature, time, stress, strain rate, etc) and have to modify as needed. Upon completion of these experiments, the students will have gained experience in this area. These experiments are supplemented with assignments in which several assigned problems deal with analysis of experimental data, for example correlating strength with grain size, answering such questions as why certain metals and alloys are ductile (based on crystal structure and defect structure), interpreting creep data, optimizing cold working for strength and ductility, etc.

Students readily grasped the concepts involving numerical calculations (such as tensile, hardness, and toughness tests), however some students had difficulty in visualizing and analyzing experiments with three dimensional atomic arrangements, crystal structures, and microstructures. Ping-pong ball models and three dimensional computer models were used successfully to supplement text book material.

3. Directly perform system, process and component selection in order to satisfy specific engineering-related needs through the application of mechanical design philosophy in engineering practice.

Assessment. About one third of the lectures are devoted to the discussion of the basic mechanical properties of deterrent materials which are key to the prediction of the behavior of a component under applied static and dynamic loads and selection of materials for different applications. About 25-30% of the assignments deal with design problems which require the students to work out problems related to process and component selection. Representative examples include the prediction of the life of a structural component containing a crack of a certain size, determining the life of a component subjected to creep at high temperatures, calculating the magnitude of stress relaxation in a polymer subjected to constant strain, determining the thermomechanical processing schedule to produce a certain strength in an alloy.

4. Communicate in oral and written presentations using graphic and/or visual media appropriate for an engineering business environment.

Assessment: Students are encouraged to participate in class room discussions. Throughout the lectures, the instructor solicits responses from students for questions directly related to the topic being covered during that lecture, previous lectures, and some recent developments in the field. Every attempt is made to get participation from each and every student. A team of 3-4 students conduct a total of nine laboratory experiments. Each student prepares nine written laboratory reports. The laboratory participation and written reports constitute 25% of the total grade.

5. Operate productively in individual or multidisciplinary, team-oriented projects.

Assessment: The assignments are multidisciplinary - they combine physics, chemistry, and engineering and they are completed by the individuals. The laboratory experiments are conducted as a team of 3-4 students.

6. Be exposed to modern developments, products and tools as they relate to engineering practice.

Assessment: The instructor who has had extensive industrial experience makes it a point to bring to the class room real world engineering examples. Because the instructor is active in materials research,

extensive coverage is given to the modern developments in the field of materials science. The instructor draws from his consulting assignments real life examples .

7. Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards.

Assessment: This goal was not addressed in the course.

8. Obtain the broad-based education necessary to understand the impact of engineering solutions in their global and societal contexts.

Assessment: The relevance of broad-based education to engineering solutions with global and societal impact is covered with appropriate examples; for example the need for reducing the weight of automotive and aircraft to lower the fuel consumption, the need for developing high performance materials to improve the efficiency of land and air based transportation, the need for developing non-lead containing solders,.. etc - such topics are discussed throughout the lectures.

9. Recognize the need for (and obtain the tools necessary to engage in) life-long learning.

Assessment: Throughout the course the fundamental principles and building blocks are emphasized and also the point is made that the application of these fundamental principles to a specific problem is a life-long learning process.

10. Be afforded the opportunities to participate in cooperative education, internships, research experiences or international exchange programs in order to gain experience beyond the classroom

Assessment: Ample opportunities are provided for the students to participate in co-op programs internships, and research experience. Upon completion of the course, several students have taken up co-op positions and internships in materials related areas and some students have worked in the instructor's research laboratory

JME 390

JME 390 Senior Design Project – Summer 2001

Course assessment:

General comments:

By the time students take this course they have been in a series of engineering science classes where the norm is closed form, preferably analytic, rather than open-ended design solutions. The challenge in this course is to free students' minds in order to utilize the inherent freedom in engineering design for the development of better products and the benefit of humankind. In order to identify the efficacy of the course in meeting the above stated objectives the students were asked to provide their opinions on the six (6) questions on the attached pages. Similar questions had been discussed as examples of design problems near the beginning of the course. The students were asked to comment on the change in their perception of design as a result of taking the course.

Near the beginning of the course answers to question (1) indicated a clear understanding on the importance of engineering calculations on the feasibility of mechanical engineering products. Answers to question (2) were vague and confused with innovation in product functions. Answers to questions (3) and (5) indicated a haphazard and random approach to the problem. Answers to question (4) indicated the students would start their design with an arbitrary and emotional specification the car should have "1.3 to 2.0 times the power of the VW Jetta", without first developing the justification of this specification for the US market, and this dominated the rest of the thought process. Answers to question (6) indicated the students would not know where and how to find information needed in order to proceed with this design problem.

Their answers to the same questions at the end of the course are in the attached pages, and they indicate that the course objectives were met.

1) Prepare students to be contributing members in practicing engineering design teams.

By the end of the course students understood the importance of the sequence of the four stages of design, and the integral role of science and engineering analysis and design in product development. Furthermore, they understood the importance of teamwork, constructive contributions in design sequences, integrated product teams, and the ways to join a design team into any stage of an ongoing design process.

2) Enable students to perform engineering design solutions (applying scientific and engineering principles), rather than "trial and error" (I hope this will work) design solutions.

The initial error of coming up with a preconceived notion of a full design solution before considering alternatives was overcome in about two weeks. The initial reluctance to use design freedom, to make assumptions, design loops, and return to make corrections to the design sequence were overcome in about 3 weeks. Then the students understood the principles of embodiment design, and the integral role of modeling engineering processes and systems in order to analyze their designs.

3) Enable students to envision, create, and critically evaluate alternative designs, and choose optimal designs among them.

All students were applying the principles of feasibility study, alternatives evaluation, and embodiment design by the fourth and fifth week of the course.

4) *Enable students to function in the iterative nature of design without being lost by the inherent design freedom.*

The design conferences enabled students to benefit from each other's ideas and expertise, and the schedule of preliminary and final reports forced the students into structured ways of design iterations. By the end of the course all students had seen the iterations in all design projects in the course, and felt familiar and comfortable with the process.

5) *The students are able to conduct (participate in or lead in) the four stages of design process (concept, feasibility, embodiment, detailed design), starting from any of the four stages (e.g., starting from another team's feasibility or embodiment design).*

The design conferences enabled students to contribute as members of several design teams, so that by the end of the course they were familiar with all design projects in the course. During the latter 60% of the course all students were making intellectual contributions to all projects, not just their own. Extrapolating from this class observation, we feel that students would be able to achieve this objective in actual engineering practice.

6) *Design engineering products with optimal use of the various alternative (continuously evolving) manufacturing techniques, materials, controls.*

The set of lectures, examples, and the design projects provided the students with expertise on how to integrate material from several engineering and science areas to achieve their design goals. Furthermore, it became clear that engineering practice is evolving, requiring that we keep updated on new skills and technologies.

7) *Design engineering products that meet regulatory, safety, environmental standards.*

The lectures, guest lecturers, and case-study materials instilled in the students the importance of these areas in engineering practice, and the perils of ignoring them.

8) *Enable students to study on their own further design concepts.*

By the end of the course students felt familiar with finding and absorbing new technical information, and using it in their designs.

A discussion of the student's revised answers to question (1)-(6) indicated a clear understanding on the engineering design process and concepts, and that the course objectives were met. In addition, after a series of presentations and discussions, all students were able to present technical material to a group of their peers, and to be contributing members of mechanical engineering design teams.

Suggestion:

Over the years there is a continuing decrease of the use of surface finishes and tolerances in course projects. We should make sure that these are adequately covered in earlier drafting classes, and continue to encourage students to use them in their drawings. This was accomplished to some degree this year, but there are indications that students need additional preparation in that area before they enter in this class.

Theodosios Korakianitis
August 2001

JME 390 – Summer 2001

First Name:

Last Name:

Local Home Telephone:

email:

Work Telephone:

email:

In order to answer the following questions, make engineering assumptions as necessary. Marks Standard Handbook for Mechanical Engineers is Available.

1. Identify five differences between Mechanical Engineering Design and Artistic Design?
(5 minutes)
2. Define Mechanical Engineering Design (5 minutes)
3. You work for a retailer supplying home-improvement products. Outline the steps required to design a mechanically-activated domestic one-car garage door mechanism.
(10 minutes)
4. You work for an automotive company. Outline the steps required to choose the main engine characteristics (displacement, number of cylinders, design rpm, power and torque etc) for a mid-size sedan to compete with the new VW Jetta.
(15 minutes)
5. Outline the steps required to design an AC-driven water pump for a 35,000 gallon underground swimming pool capable of circulating the pool water in 90 minutes.
(10 minutes)
6. Outline the steps required to design the main propeller shaft for a low speed marine diesel engine. The engine delivers 60,000 hp at 80 rpm. The shaft is 15 m long. The stern bearing is 1 m long. The 6-bladed propeller weighs 12,000 kg. See the sketch below.
(15 minutes)

Memo

September 20, 2001

TO: Professor Gomez

FROM: R. A. Gardner

SUBJECT: Assessment of JME 325, Su 2001 needed by 10/5/01

Mario,

As part of the ongoing assessment process for all courses in the Joint Program I need for you to write up an assessment of JME 325 which was offered in Summer 2001.

I have attached your previous assessment from Su 2000 along with the minutes of the Undergraduate committee, which reviewed the Su 2000 courses in April.

In addition, I have attached two pages which correlate the ABET "a" through "k" objectives with out 10 mechanical engineering objectives.

In order to make this process go a little easier I will email you an attachment in MS word, which will have the ten objectives of the program. You can just pick those that are identified as goals in your course and add a paragraph of assessment. Email me back your completed assessment as an attachment.

The undergraduate committee will meet during the week of October 8 so I need to receive your assessment by 10/5/01. That gives you only two weeks. Let me know if this is a problem or if any further information is needed.

External Advisory Board Minutes

Minutes of Joint ME Program External Advisory Board
November 12, 2003

Present:

Alan Atkins, Swami Karunamoorthy, Dave Peters,
Dick Gardner, Ken Jerina, Ramesh Agarwal

Absent:

Harold Law, Hal Faught

Dick Gardner gave a presentation of the goals, objectives, and outcomes in UM-St. Louis joint program. The committee members discussed each goal individually. They commented on the strengths and weaknesses of individual goals. There was also a discussion of which goals needed to be modified as to how they were worded for our day school program as opposed to our joint program. We also discussed as to whether any other goals needed to be added to the list. This was not the first time that the External Board has seen these goals, since they were also discussed at a meeting two years ago. The consensus of opinion was that the goals, in their present form, meet the needs of our constituencies, industry, graduate schools, and the students.

Next, the committee discussed the assessment tools that we use to evaluate our program. Two members of the committee are ABET Evaluators, and they helped us by talking about what other schools are doing and what ABET considers the best practices. We discussed the measurement of outcomes as well as the feedback measures to change outcomes. Each of the tools in our Joint Program Report was discussed. The committee like our assessment measures but encouraged us to look further into the FEA exam as a possible tool.

Some comments are as follows:

Take the a) through k) of ABET and personalize them for each of the technical stems within the ME degree. Thus, each would be specialized for thermo-fluids, structures and materials, dynamics and control, and design.

Use the capstone design course as a forum to measure outcomes of other courses. In other words, since the capstone design course utilizes the material taken in previous courses, the capstone design course should allow its instructor to assess how well the students have retained knowledge from previous courses and how well they are able to integrate it into a design process. This, then, can provide feedback to the earlier instructors.

Let Professors in the earlier courses write questions that could be combined to form a comprehensive exam that would be administered in the design course. Since the Design Professor is separate from the other classes, this can give more of an independent assessment than the final exams in the other courses..

We should develop some creative strategies to encourage more students to take the FEA exam. Some possibilities would include having UMSL pay the fee, making the exam part of an FEA course required for graduation, or finding an online service that might administer an exemplar exam for us.

Next Prof. Ken Jerina gave a presentation on computing in the undergraduate curriculum and how we can improve it. The joint program students obtain most of their computing while in the pre-engineering program, while the day school students obtain it from our own Computer Science Department. However, we often find a significant percent of the class (in either program) is not adequately prepared for computing at the upper levels.

A long discussion was held as to what our students need to know for entering the work place or for entering graduate school. We next discussed whether the engineering program or the computer science program was better in delivering the proper knowledge to the students.

After discussing this with the External Advisory Board, the following suggestions were reached. We plan to implement these first in the Day School, then evaluate how well they are working, and then make a decision about both the WU and UMSL programs.

Make MATLAB the primary computing language

Create our own computing course to cover both language and numerical methods

Make sure course includes how to transform engineering problems into computer problems.

Power Point and Excel should be taught in non-credit freshman courses.

QUESTIONS FOR EXTERNAL ADVISORY BOARD

Meeting Monday, April 18, 2005

Members of the Board:

Alan Atkins, V.P. of Technology, Boeing St. Louis
Hal Faught, retired V.P. of Engineering and Technology, Emerson Electric
Swami Karunamoorthy, Professor of Mechanical and Aerospace Engineering,
former Assistant Dean of Engineering, St. Louis University
Harold Law, former Government employee, Pres. of CPCI Consultants.

1. From an industry or grad school point of view, how would you look at various solutions to class size issues for us?
 - a. Have senior sections as large as 50 students OK if great teacher there.
 - b. Split section but keep same professor on both sections.
 - c. Use affiliate (adjuncts) to teach extra sections
 - d. Use graduate students to teach extra sections or some lectures in each.

The Board felt that we should do everything possible to limit class sizes to 30 students. This should be done primarily by adding more full-time faculty as opposed to using graduate students or affiliates. A Department of Mechanical and Aerospace Engineering should have at least 20 full-time faculty to do research and teaching effectively. Thus, we need to add 3.5 faculty to our Department. The role of affiliates and adjuncts has reached a critically large level.

2. Our students claim that many job postings ask for experience in PRO-E or Labview. Is this a real issue, or is it fine for our students to have experience in some software but not necessarily that one? For example, we teach Solid-Edge and Testpoint because they interact with MATLAB.

The External Advisory Board felt that these were non-issues. Industry does not care what CAD software our engineers use. Industry will send our graduates to special training to use whatever software is in vogue at the time. (Boeing is in the middle of a change in software.) Similarly with lab software. Our students should be familiar with some software, but it was unimportant to them which software. Dr. Karunamoorthy thought it very important to have a common software across all ME and AE courses.

3. From an industry or graduate school perspective, what is the trade-off between learning new, state-of-the-art laboratory software tools and getting hands-on experience with laboratory equipment?

The Board felt that students must be exposed to the latest laboratory software and technology. On the other hand, students also need hands-on experience for the feel of labs. They suggested two different kinds of laboratory exercises. The first would be more hands-on qualitative experiments that could be done before the analytic material was presented in class. This would give motivation for the learning

experience. Then, after the classroom theory, labs more qualitative and high-tech in nature could be performed in which data analysis was emphasized.

4. We used to have a strong research relationship with Boeing through the Boeing Foundation. Do you all have ideas for how we could develop this type of relationship with other industries or renew it with Boeing?

The Board suggested that we set up a brainstorming session with Boeing (or with any company) to talk about ways to partner and go after money. Alan Atkins said that there were many champions of WU at Boeing who would love to get something going in this way. This could be done by approaching DARPA, by bidding on STTR's, or by applying for foundation money.

5. Are there technology thrusts that we should be covering in our undergraduate education that perhaps you see from your point of view that we are missing?

In Aerospace, we are missing an airplane performance course and an aircraft design course. This should be an area in which we look for new faculty. The Board would like to see more emphasis on creativity and innovation in the design curriculum. They were strongly opposed to the idea of an engineering-wide ethics course. They questioned why engineers do not understand ethical standards in general. A few case studies (as we do now in ME 404T) was felt to be more than sufficient.

6. How do you view our co-op programs? Do you have experience with this? What would your recommendation be to students thinking about a co-op?

The Board felt that the coop experience was overrated. In cases for which the student is unsure about engineering and wants some experience, it is all right. In general, however, it slows the student down and stops momentum. Boeing, for example, does not consider a coop as having an advantage over other students who have not cooperated.

7. How do you view the B.S. in Aerospace Degree *vis á vis* the B.S. in Mechanical Engineering Degree? Are you looking for something different between students with one degree or the other?

The two degrees are so similar that it really does not make that much difference. An ME degree is broader and is generally preferred for students not sure. However, students should follow their passion. If they have a love of aerospace, then they should pursue the AE degree.

8. How much do you look at minors when hiring an individual out of school? Does a minor make a difference to you?

Employers look highly favorably on minors. It shows that a student has a focus and has pursued that focus giving them a breadth beyond their major. The Board

wanted to know why we have the minors we do. Was it marketing or faculty interest that drove this? We said that it was some of both. They like our minors very much.

Minutes of the AE Industrial Advisory Board (IAB) Meeting
Department of Mechanical and Aerospace Engineering (MAE)
Washington University in St. Louis
9 December 2005

Attendees: IAB: Dr. William Bower (Boeing), Dr. David Dunavant (Systems & Electronics, Inc), Dr. Thomas Giolda (Whirlpool), Dr. Matthew Thomas (Boeing);
MAE: Dr. Ramesh Agarwal, Dr. Kenneth Jerina, Dr. David Peters

1. The attendees met at 12:30p.m. in Whittemore House for lunch and informal discussion.
2. The meeting started at 2:00p.m. in MAE conference room in Jolley Hall. After the introduction of the members, Dr. Agarwal proceeded with a Power Point Presentation, covering the following items: (a) Brief history behind establishing the BSAE program, (b) Missions and goals of the program, (c) Outline of the curriculum, (d) Description of aerospace courses, (e) Aerospace faculty and their research focus, (f) Discussion of ABET requirements for accreditation, (g) BSAE enrollment and graduation data since its inception in 2003, and (h) Combined BSAE/MSAE five year program.
3. During the presentations, IAB members raised several questions and made several suggestions. Some of the IAB members strongly emphasized the need for providing a more intense training to the students in geometry and solid modeling software such as PRO-E, Catia or Unigraphics. Currently we teach Solid-Edge and Testpoint at WU because they are interactive with MATLAB. A suggestion was made that we offer a course in aircraft performance or include it in the aerodynamics, and aircraft flight dynamics and control courses. The IAB members felt that that the topics such as aircraft safety, experimental techniques, systems simulation, design of experiments, and optimization should also be integrated into the undergraduate curriculum in some fashion.
4. There was some discussion also about the nature and strength of our co-op program.
5. A questionnaire was given to the IAB members to provide additional inputs and critique of our BSAE program.
6. The meeting was adjourned at 4:45p.m.

Washington University Mechanical and Aerospace Engineering Department
External Advisory Board Meeting
March 16, 2006

Attendance

Washington University:

Prof. Ken Jerina
Prof. Phil Bayly
Prof. Ramesh Agarwal
Antonio Hsieh (graduate student)
Emmanuel Okpara (graduate student)

External Panel:

Joe Gierer (Emerson Tool Company)
Charlie Saff (The Boeing Company)
Harold Law (retired)
Brandon Buerge (Microflight)

Executive Summary

The panel reviewed the state of the department. The major observations of the panels are: (1) MAE is in good position in undergraduate education; successfully attracting and training undergraduate students. (2) To improve our ability to perform high-level research and graduate education, we need to continue to identify and focus on areas in which WU can excel. (3) WU MAE should seek opportunities (as in the current searches) to recruit faculty with track records of distinguished research to jump-start this process. (4) The transition between Deans offers an opportunity to influence the strategic plan of the School and University. (5) A sound, realistic, strategic plan for the MAE department is a prerequisite for influencing the plans of the School and University. How can WU MAE distinguish itself?

Minutes

Dr. Jerina opened the meeting at 9:00(Dr. Jerina was standing in for Dr. Peters who had been called to research planning meeting at Georgia Tech).

The panel toured two labs: (1) Vibrations – Jolley 111; (2) Fluids – Urbauer 320.

Vibrations Lab: The MAE 417 lab course is offered concurrently with MAE 417 lecture course. Antonio Hsieh described the organization and grading of vibrations labs. He explained several hands-on labs (1-DOF, 5-DOF, and continuous systems) and provided an overview of the two design labs.

Comments:

- “Helpful to have lab offered concurrently to reinforce lecture material.” (Saff)
- “Logistical problems arise in getting 50-60 students through a single lab every two weeks.” (Bayly)
- “Are design problems for labs solicited from industry?” (Law)

Fluids Lab: This lab is offered the semester following the fluid mechanics course (MAE 370). Emmanuel Okpara demonstrated several exercises and described the organization of the lab course, in which students rotate through each experiment.

Comments:

- “Experiments have a natural order, but are typically not done in this sequence.” (Saff) Explanation was given that this is due to logistics of getting 100 students through all six labs.
- “Fluids lab serves several departments (ME, CE, BME).” (Gierer)
- “Large class size is partly due to the fact that lab courses are offered only once per year.” (Law)

General comments during lab tour:

- Charlie Saff noted that at Purdue, multi-disciplinary lab experience is a new goal. I.e., students from multiple engineering disciplines will work together, as they would in industry. He pointed out potential benefits and difficulties.
- Related idea of multi-disciplinary design projects was raised.
- Charlie also pointed out Purdue’s School of Aerospace planning model, hiring faculty in advance of enrollment increases.
- Joe Gierer inquired about possible departmental and school plans for growth, noting high student quality. Ken Jerina explained current WU enrollment limits.

State of the MAE Department and School of Engineering (Ken Jerina)

Ken Jerina presented enrollment trends and admissions data.

Undergraduate Education

- Data reflect high undergraduate enrollment in MAE, and continuing impressive performance of WU undergraduates. Factors responsible for high interest in MAE include employability of MEs and interest in aerospace major.
- The effect of the aerospace major was discussed. It is acknowledged to contribute both to higher enrollments/tuition (pro) and increased teaching and advising loads (con).
- The Joint UMSL-WU program was discussed. Charlie Saff noted that the program was attractive to students. The panel in general noted that the effort required to maintain this program in addition to the standard MAE undergraduate and graduate programs was significant. The relative performance of UMSL vs regular WU students was discussed; the UMSL students span a wider range, including excellent and marginal students.

Research and Graduate Education

- Brandon Buerge noted growth in MAE research funding from 1997-2004 (from ~\$1M to ~\$2M).
- Graduate applications are also increasing.
- The status of searches was discussed. The panel suggested that attracting an established professor (vs. a new graduate) would be desirable, if possible, to accelerate the department’s efforts to improve its stature.
- Charlie Saff emphasized the importance of developing a clear vision of departmental identity and priorities. A strategy for attaining excellence in targeted areas is essential.
- Alternate energy sources is a promising research area. (Law)
- The transition to a new Dean may provide opportunity to influence school strategy (Gierer).

- A vision and strategic plan for the department is crucial to growth. What type of student are we trying to produce? Our research program and facilities need to increase if our goal is to be ranked with Hopkins and Princeton. (Saff)
- If we align our goals with University objectives (Biomedical, Environmental, Materials, Alternative Energy) our options and chance of success will improve. (Saff, Gierer, Law)

General observations

- CS 265 was poorly taught and organized. MAE 265 should be clear improvement (Buerge).
- CAD tools, data acquisition tools and simulation tools are well chosen. Specific choices are not that important, but exposure is helpful.
- Project management is an important skill. Exposure in design courses and in dedicated coursework is helpful.
- A dedicated Ethics course may not be necessary or effective, though case studies in regular engineering courses may be very helpful.
- Design for “Six-Sigma” may be a useful addition to design or probability and statistics curriculum.

APPENDIX I – G

Assessment Feedback

2.) Alumni Data

School of Engineering and Applied Science
Washington University

Engineering Career Services Placement Report
Academic Year 2002-2003

Degree: Mechanical Engineering

BS Graduates 28

Employment Statistics

Not Reported	7	25%
Seeking Employment	5	18%
Accepted Jobs	6	22%
Seeking Advance Degree	7	26%
Performing Volunteer Work / Other	3	11%
Total Placed	16	76%

Financial Statistics of Employed Graduates

Salaries Reported	4
High	70000
Low	20000
Median	51200
Mean	55100
Bonuses Reported	3
High	10000
Low	2000
Mean	4833

School of Engineering and Applied Science
Washington University

Engineering Career Services Placement Report
Academic Year 2002-2003

Degree: Biomedical Engineering

BS Graduates 50

Employment Statistics

Not Reported	11	22%
Seeking Employment	5	10%
Accepted Jobs	16	32%
Seeking Advance Degree	17	34%
Performing Volunteer Work / Other	1	2%
Total Placed	34	87%

Financial Statistics of Employed Graduates

Salaries Reported	10
High	65000
Low	40000
Median	60000
Mean	56800
Bonuses Reported	3
High	5000
Low	750
Mean	3583

-Authentication-Warning: mecf.wustl.edu: iscan owned process doing -bs
X-Sender: dap@mecf.wustl.edu
Date: Thu, 30 Jun 2005 13:50:44 -0500
To: nancy@me.wustl.edu
From: David Peters <dap@me.wustl.edu>
Subject: Fwd: RE: Draft Alumni/ae Survey

X-Authentication-Warning: mecf.wustl.edu: iscan owned process doing -bs
Subject: RE: Draft Alumni/ae Survey
Date: Mon, 13 Jun 2005 15:00:28 -0500
Thread-Topic: Draft Alumni/ae Survey
Thread-Index: AcRwwXpzp6otXsxrR5+BDhZuDQ91zz/h2pxg
From: "Darby, Bill" <darby@seas.wustl.edu>
To: "Darby, Bill" <darby@seas.wustl.edu>, "Arthur, Martin" <rma@ese.wustl.edu>, "Brandenburger, Gary H." <g.h.brandenburger@ieee.org>, "BYRNES, CHRIS" <ChrisByrnes@seas.wustl.edu>, "Chamberlain, Roger" <roger@cse.wustl.edu>, <dudu@che.wustl.edu>, "Kroeger, Chris" <ChrisKroeger@seas.wustl.edu>, "Moll, Mike" <MikeMoll@seas.wustl.edu>, "Peters, David A." <dap@me.wustl.edu>, "Catalin Roman" <roman@wustl.edu>, "Sridharan, Srinivasan" <ssrid@seas.wustl.edu>, "Truman, Kevin" <KTrum@seas.wustl.edu>, "Yin, Frank" <yin@biomed.wustl.edu>, "Turner, Jay" <JRTurner@seas.wustl.edu>, "Ramachandran, P." <rama@che.wustl.edu>, "Mukai, Hiroaki" <mukai@zach.wustl.edu>
Cc: "Jolley, David" <david_jolley@aismail.wustl.edu>, "Reinschmidt, Susan" <susan@seas.wustl.edu>, "Shilling, Kim" <KShilling@seas.wustl.edu>, "Ballard, James" <JBall@seas.wustl.edu>

Dear Colleagues,

Below is a draft of the e-mail I plan to send to all 2004 engineering undergraduate alums, as well as to those who received undergraduate degrees between 1999 and 2003 and who did not respond to last year's alumni survey. That is, no one who responded last year is being contacted this year. As last year, the e-mail will be personalized. That is, the salutation will read, "Dear Mr. Smith." Currently, we have e-mail addresses from Alumni & Development for 476 alums, as described above. I guess I'll find out how many of them work.

Included in the e-mail below is a hyperlink to the online version of the survey instrument. Please feel free to try it out, explore, whatever. There are logical skips built into the instrument: Depending upon your answers to some questions, other questions may or may not appear. If you'd like to see all the questions, do not enter any responses and keep selecting "Next >>."

There are really only two changes from last year's version:

1. The choices in question #13 have been revised to be more inclusive of CS majors. (Thanks for your help, Catalin.)
2. Question #37 focuses on how useful alums think a required course in engineering ethics would be. (Last year, that question focused on a course blending engineering and business.)

My plan is to send this to the alums on Friday afternoon, June 17, 2005. The response rate seems to be increased by an initial contact on Friday afternoon. My guess is people are "winding down" and looking for a diversion from their jobs. We're happy to provide it.

Many thanks for your help.

Best,
Bill

Dear XXXXX:

We are contacting a selected group of recent graduates of the engineering school. We would greatly appreciate it if you would take about 15 minutes of your time to help us improve the undergraduate experience for Washington University engineering students.

Below is a secure hyperlink to an anonymous online survey that asks for your impressions of how well your undergraduate engineering education is serving you.

<https://www.surveymk.com/s.asp?u=94289837300>

This annual survey is part of our efforts to collect feedback from current students and graduates. We will use this information in our continuous efforts to review and improve our undergraduate engineering programs. The results of our annual surveys will be made available to the visiting team representing the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) during the next visit.

ABET is the agency that accredits our professional undergraduate engineering degrees, so your participation in this survey is very important to us. Many thanks, in advance, for helping us.

Best regards,

Results Summary

Filter Results

To analyze a subset of your data, you can create one or more filters.

Total: 271
Visible: 49

1. Untitled Page

1. When did you receive your undergraduate engineering degree from Washington University (year)?

	Response Percent	Response Total
1998	10.2%	5
1999	26.5%	13
2000	20.4%	10
2001	8.2%	4
2002	20.4%	10
2003	14.3%	7
2004	0%	0
Other (please specify)	0%	0
Total Respondents		49
(filtered out)		222
(skipped this question)		0

2. Please check one response below.

	Response Percent	Response Total
I entered Washington University as a freshman intending to major in engineering.	59.2%	29
I entered Washington University as a freshman not intending to major in engineering.	14.3%	7
I entered Washington University through the Dual Degree (3-2) Program from an affiliated school.	12.2%	6
I entered Washington University as a transfer student (non-Dual Degree).	14.3%	7
Other (please specify)	0%	0
Total Respondents		49

(filtered out) 222
 (skipped this question) 0

3. In which field(s) did you earn your undergraduate engineering degree(s) at Washington University? (Please check all that apply.)

	Response Percent	Response Total
Aerospace	0%	0
Biomedical	0%	0
Chemical	0%	0
Civil	0%	0
Computer Engineering	0%	0
Computer Science	0%	0
Electrical	0%	0
Mechanical	100%	49
Physics	0%	0
Systems Science and Engineering	0%	0
Other (please specify)	0%	0
Total Respondents		49
(filtered out)		222
(skipped this question)		0

4. Did you have a minor in the engineering school at Washington University?

	Response Percent	Response Total
Yes	10.2%	5
No	89.8%	44
Total Respondents		49
(filtered out)		221
(skipped this question)		1

2. Untitled Page

5. I completed the following minor(s) in the engineering school at Washington University. (Please check all that apply.)

	Response Percent	Response Total
Aerospace	20%	1
Computer Science or Foundations of Computing	40%	2
Electrical Engineering	0%	0

	Environmental Engineering Science	0%	0
	Manufacturing	0%	0
	Robotics	20%	1
	Structures	0%	0
View	Other (please specify)	20%	1
Total Respondents			5
(filtered out)			14
(skipped this question)			252

3. Untitled Page

6. Did you earn any other degrees, majors, or minors at Washington University?

		Response Percent	Response Total
Yes		32.7%	16
No		67.3%	33
Total Respondents			49
(filtered out)			222
(skipped this question)			0

4. Untitled Page

7. Did you earn a graduate degree from the engineering school at Washington University through the BS/MS program?

		Response Percent	Response Total
Yes		30.8%	4
No		69.2%	9
Total Respondents			13
(filtered out)			85
(skipped this question)			173

8. Please list all degrees, majors, and minors you've earned at Washington University, excluding your undergraduate engineering degree(s) and engineering minor(s).

		Response Percent	Response Total
View	Undergraduate degrees	25%	4
View	Majors	18.8%	3
View	Minors	43.8%	7
View	Graduate degrees	50%	8

Total Respondents	16
(filtered out)	89
(skipped this question)	166

5. Untitled Page

9. Are you registered in any state or other jurisdiction as a professional engineer (P.E. or equivalent) or an engineer-in-training (E.I.T. or equivalent)?

	Response Percent	Response Total
No	81.2%	39
Yes, as an E.I.T. or equivalent	14.6%	7
Yes, as a P.E. or equivalent	4.2%	2
Total Respondents	48	
(filtered out)		217
(skipped this question)		6

10. What is the highest degree you have earned?

	Response Percent	Response Total
Bachelor's	66.7%	32
Master's	31.3%	15
Doctorate	0%	0
Professional (for example, M.D., J.D., D.V.M.)	2.1%	1
Other (please specify)	0%	0
Total Respondents	48	
(filtered out)		219
(skipped this question)		4







11. Please answer the following.

	Yes	No	Response Total
I am enrolled (full-time or part-time) at a college or university.	27% (9)	73% (24)	33
I am pursuing a degree (full-time or part-time) at a college or university.	28% (9)	72% (23)	32
I am the author or co-author of at least one published book.	0% (0)	100% (31)	31
I am the author or co-author of at least one published technical paper	10% (3)	90% (28)	31

(in a printed or an electronic journal or trade publication).

I hold at least one patent.	3% (1)	97% (30)	31
I am a member of at least one engineering-related professional society.	43% (15)	57% (20)	35
		Total Respondents	36
		(filtered out)	171
		(skipped this question)	64

12. Which of the following best describes your principal occupation?

		Response Percent	Response Total
Engineering employment		45.8%	22
Engineering and management employment		16.7%	8
Graduate school in an engineering field (full-time)		16.7%	8
Graduate school in a non-engineering field (full-time)		2.1%	1
Non-engineering employment		14.6%	7
Unemployed and seeking employment		4.2%	2
Unemployed and not seeking employment		0%	0
Retired		0%	0
		Total Respondents	48
		(filtered out)	219
		(skipped this question)	4

6. Untitled Page

13. Which one of the following activities describes your work most accurately?

		Response Percent	Response Total
Design engineering		30%	9
Consulting engineering		6.7%	2
Construction		3.3%	1
Engineering research/development		13.3%	4
Scientific research		0%	0
Manufacturing		23.3%	7

	Sales engineering	0%	0
	Technical management	6.7%	2
	General management	3.3%	1
	University teaching	0%	0
View	Other	13.3%	4
	Total Respondents		30
	(filtered out)		126
	(skipped this question)		115

7. Untitled Page

14. Which one of the following engineering specialties describes your technical work most accurately?

		Response Percent	Response Total
	Aerospace	23.7%	9
	Biomedical	5.3%	2
	Chemical	2.6%	1
	Civil	0%	0
	Computer Engineering	0%	0
	Computer Science	5.3%	2
	Electrical	0%	0
	Enviornmental	0%	0
	Mechanical 	50%	19
	Physics	0%	0
	Structural	0%	0
	Systems	2.6%	1
View	Other	10.5%	4
	Total Respondents		38
	(filtered out)		146
	(skipped this question)		87

8. Untitled Page

15. What is the title of the position you hold?

View	Total Respondents	44
	(filtered out)	196
	(skipped this question)	31

16. How well did your undergraduate education in the School of Engineering and Applied Science at Washington University prepare you for your present position or field of study?

	Response Percent	Response Total
Poorly = 1	0%	0
2	8.7%	4
3	28.3%	13
4	30.4%	14
Very well = 5	32.6%	15
Total Respondents		46
(filtered out)		213
(skipped this question)		12

9. Untitled Page

17. How would you describe the following characteristics of your advisor while you were an undergraduate student in the engineering school at Washington University?




	Poor = 1	2	3	4	Excellent = 5	Response Average
Knowledge of the major and graduation requirements	2% (1)	2% (1)	15% (7)	33% (16)	48% (23)	4.23
Availability	2% (1)	6% (3)	27% (13)	29% (14)	35% (17)	3.90
Approachability	2% (1)	17% (8)	10% (5)	35% (17)	35% (17)	3.85
Ability to offer career counseling	12% (6)	25% (12)	17% (8)	27% (13)	19% (9)	3.15
Role as a mentor	17% (8)	23% (11)	17% (8)	21% (10)	23% (11)	3.10
Total Respondents						48
(filtered out)						214
(skipped this question)						9

18. How would you describe your undergraduate engineering education?

	Response Percent	Response Total
Easy = 1	0%	0
2	0%	0
3	22.9%	11
4	60.4%	29
Extremely difficult = 5	16.7%	8
Total Respondents		48
(filtered out)		215

(skipped this question) 8

19. How well did your mathematics course work in freshman and sophomore years prepare you for engineering course work?

	Response Percent	Response Total
Poorly = 1 	2.1%	1
2 	10.4%	5
3 	29.2%	14
4 	35.4%	17
Very well = 5 	22.9%	11
Total Respondents		48
(filtered out)		214
(skipped this question)		9

10. Untitled Page

20. Please identify the area(s) of difficulty involving your mathematics course work.

View Total Respondents	5
(filtered out)	12
(skipped this question)	254

21. What could have been done to prepare you better?

View Total Respondents	5
(filtered out)	15
(skipped this question)	251

11. Untitled Page

22. How well did your basic science course work in freshman and sophomore years (for example, physics, chemistry, and biology) prepare you for engineering course work?

	Response Percent	Response Total
Poorly = 1 	2.1%	1
2 	8.3%	4
3 	27.1%	13
4 	41.7%	20
Very well = 5 	20.8%	10

Total Respondents 48
 (filtered out) 212
 (skipped this question) 11

12. Untitled Page

23. Please identify the area(s) of difficulty involving your basic science course work.

Total Respondents 4
 (filtered out) 13
 (skipped this question) 254

24. What could have been done to prepare you better?

Total Respondents 5
 (filtered out) 11
 (skipped this question) 255

13. Untitled Page

25. How well do you think your undergraduate engineering education at Washington University prepared you?

	Poorly, not at all = 1	2	3	4	Very well = 5	Response Average
To apply knowledge of mathematics, science, and engineering	0% (0)	8% (4)	19% (9)	44% (21)	29% (14)	3.94
To design and conduct experiments	0% (0)	6% (3)	23% (11)	56% (27)	15% (7)	3.79
To analyze and interpret data	0% (0)	2% (1)	17% (8)	52% (25)	29% (14)	4.08
To design a system, component, or process to meet desired needs	4% (2)	6% (3)	29% (14)	44% (21)	17% (8)	3.63
To function on multidisciplinary teams	0% (0)	12% (6)	21% (10)	31% (15)	35% (17)	3.90
To identify, formulate, and solve engineering problems	0% (0)	4% (2)	12% (6)	48% (23)	35% (17)	4.15
To understand professional and ethical responsibility	0% (0)	4% (2)	25% (12)	44% (21)	27% (13)	3.94
To communicate effectively	4% (2)	6% (3)	38% (18)	29% (14)	23% (11)	3.60
To understand the broad impacts of engineering solutions in a global and societal context	8% (4)	12% (6)	29% (14)	38% (18)	12% (6)	3.33
To recognize the need for, and to engage in, life-long learning	2% (1)	17% (8)	17% (8)	35% (17)	29% (14)	3.73
To understand contemporary social issues	19% (9)	23% (11)	35% (17)	17% (8)	6% (3)	2.69

To use the techniques, skills, and modern engineering tools necessary for engineering practice	8% (4)	15% (7)	23% (11)	44% (21)	10% (5)	3.33
				Total Respondents	48	
				(filtered out)	212	
				(skipped this question)	11	

14. Untitled Page

26. During the first week of your various courses at Washington University, overall, how well did your engineering instructors communicate the nature of the course and your responsibilities?

	Response Percent	Response Total
Vaguely, not at all = 1	0%	0
2	4.3%	2
3	23.4%	11
4	61.7%	29
Very clearly, precisely = 5	10.6%	5
Total Respondents	47	
(filtered out)	212	
(skipped this question)	12	

27. Overall, during your undergraduate education at Washington University, how successful were you in communicating with the engineering faculty outside of classroom hours (for example, by e-mail, by telephone, or during office hours)?

	Response Percent	Response Total
Not successful at all = 1	0%	0
2	8.5%	4
3	29.8%	14
4	34%	16
Very successful = 5	27.7%	13
Total Respondents	47	
(filtered out)	211	
(skipped this question)	13	

28. Overall, during your undergraduate education at Washington University, do you feel that your engineering instructors gave you a good sense of engineering in the "real world"?

	Response Percent	Response Total
Strongly disagree = 1	10.6%	5

2		19.1%	9
3		34%	16
4		25.5%	12
Strongly agree = 5		10.6%	5
		Total Respondents	47
		(filtered out)	212
		(skipped this question)	12

29. Overall, during your undergraduate education at Washington University, how well did the engineering instructors communicate the objectives and relevance of the experiments prior to conducting the work in laboratory courses?

		Response Percent	Response Total
Vaguely, not at all = 1		4.3%	2
2		6.4%	3
3		38.3%	18
4		42.6%	20
Very clearly, precisely = 5		8.5%	4
		Total Respondents	47
		(filtered out)	212
		(skipped this question)	12

15. Untitled Page

30. Overall, how well do you feel the instructors in your undergraduate engineering courses at Washington University prepared you to undertake the following academic tasks?

	Poorly, not at all = 1	2	3	4	Very Well = 5	Response Average
Homework/class projects	0% (0)	0% (0)	38% (18)	49% (23)	13% (6)	3.74
Laboratories	0% (0)	9% (4)	32% (15)	51% (24)	9% (4)	3.60
Making presentations of your work	4% (2)	7% (3)	30% (14)	48% (22)	11% (5)	3.54
Total Respondents						47
(filtered out)						210
(skipped this question)						14

31. Please list any undergraduate engineering courses at Washington University where you feel the instructor did not prepare you satisfactorily to undertake the homework assignments, projects, or laboratory work:

<input type="button" value="View"/>	Total Respondents	22
	(filtered out)	96
	(skipped this question)	153

32. Please list any undergraduate engineering courses at Washington University where you feel the instructor generated such enthusiasm for the material that you were excited to be learning it.

View	Total Respondents	33
	(filtered out)	136
	(skipped this question)	102

16. Untitled Page

33. During your undergraduate education at Washington University, were you involved in any faculty member's research project or other scholarly or professional work, whether for credit, for pay, or as a volunteer?

		Response Percent	Response Total
No		53.2%	25
Yes		46.8%	22
	Total Respondents		47
	(filtered out)		210
	(skipped this question)		14

17. Untitled Page

34. With whom did you work on research as an undergraduate student? (Please check all that apply.)

		Response Percent	Response Total
One or more engineering faculty member(s) at Washington University		95.2%	20
One or more medical school faculty member(s) at Washington University		4.8%	1
One or more arts and sciences faculty member(s) at Washington University		4.8%	1
One or more faculty member(s) from another division of Washington University		4.8%	1
View Other (please specify)		9.5%	2
	Total Respondents		21
	(filtered out)		101
	(skipped this question)		149

18. Untitled Page

35. During your undergraduate education at Washington University, did you participate in any of the following activities or programs? (Please check all that apply.)






	Response Percent	Response Total
Cooperative Education Program	29.3%	12
LeaderShape	17.1%	7
Engineering Orientation	26.8%	11
EN-120 (Freshman Seminar) as a student	36.6%	15
EN-120 (Freshman Seminar) as an instructor or a facilitator	14.6%	6
EnCouncil	24.4%	10
Summer internship	41.5%	17
Student chapter of a professional engineering society (for example, IEEE, ASCE, SWE)	53.7%	22
Engineering honor society (for example, Tau Beta Pi, Chi Epsilon, Eta Kappa Nu)	39%	16
Mentoring	9.8%	4
Career Services programs (for example, résumé-writing workshop, mock interviewing)	39%	16
Study abroad or international exchange	4.9%	2
Student Advisory Board	0%	0
Tutoring (as a tutor)	19.5%	8
Tutoring (as a user)	24.4%	10
Total Respondents		41
(filtered out)		189
(skipped this question)		41

36. From your present vantage point, how would you rate the relevance of your undergraduate engineering education at Washington University to your career and professional goals?

	Response Percent	Response Total
Essentially irrelevant = 1	2.1%	1
2	14.9%	7
3	25.5%	12
4	40.4%	19
Highly relevant = 5	17%	8
Total Respondents		47
(filtered out)		210
(skipped this question)		14

19. Untitled Page

37. To what extent would you agree that your undergraduate engineering education would have been enhanced by a required course highlighting factors that bridge business and engineering? (Topics in such a course might include transfer of technology from the laboratory to the corporation, intellectual property, government regulation, and product liability.)

	Response Percent	Response Total
Strongly disagree = 1 	4.3%	2
2 	8.7%	4
3 	17.4%	8
4 	26.1%	12
Strongly agree = 5 	43.5%	20
Total Respondents		46
(filtered out)		207
(skipped this question)		18

38. Please list additional electives you think should have been offered as part of your undergraduate engineering course work at Washington University.

View Total Respondents	25
(filtered out)	88
(skipped this question)	158

39. Please list what you perceive to be the strengths of your undergraduate engineering education at Washington University.

View Total Respondents	29
(filtered out)	136
(skipped this question)	106

40. Please list what you perceive to be weaknesses of your undergraduate engineering education at Washington University.

View Total Respondents	29
(filtered out)	136
(skipped this question)	106

20. Untitled Page

41. Overall, how strongly would you encourage a talented high school senior to pursue an undergraduate degree in engineering and enter the engineering profession?

Response Response

	Percent	Total
Strongly discourage = 1	0%	0
2	8.7%	4
3	15.2%	7
4	30.4%	14
Strongly encourage = 5	45.7%	21
Total Respondents		46
(filtered out)		207
(skipped this question)		18

42. Overall, how strongly would you encourage a talented high school senior to pursue an undergraduate engineering degree at Washington University?

	Response Percent	Response Total
Strongly discourage = 1	0%	0
2	13%	6
3	21.7%	10
4	34.8%	16
Strongly encourage = 5	30.4%	14
Total Respondents		46
(filtered out)		206
(skipped this question)		19

43. Please rate the following facilities at Washington University:

	Poor = 1	2	3	4	Excellent = 5	Response Average
Center for Engineering Computing (CEC)	0% (0)	4% (2)	13% (6)	46% (21)	37% (17)	4.15
Laboratories in your engineering major	4% (2)	17% (8)	30% (14)	37% (17)	11% (5)	3.33
Laboratories in other fields	0% (0)	5% (2)	54% (22)	29% (12)	12% (5)	3.49
Olin Library	7% (3)	7% (3)	48% (22)	30% (14)	9% (4)	3.28
Classroom/audio visual equipment	2% (1)	28% (13)	35% (16)	28% (13)	7% (3)	3.09
Total Respondents						46
(filtered out)						207
(skipped this question)						18

44. We are interested in any other comments you would like to make that could help us in our goal of continuously improving the undergraduate engineering experience at Washington University:

View	Total Respondents	16
	(filtered out)	55
	(skipped this question)	200

21. Untitled Page

45. Your Gender:

	Response Percent	Response Total
Male	82.6%	38
Female	17.4%	8
Total Respondents	46	
(filtered out)		206
(skipped this question)		19

46. Your age in years

View	Total Respondents	45
	(filtered out)	202
	(skipped this question)	24

47. Your ethnic background (Please check all that apply):

	Response Percent	Response Total
African-American, Black	4.5%	2
Native American, Alaska Native	0%	0
Asian American	9.1%	4
Asian, including Indian Subcontinent	4.5%	2
Hispanic, Latino	0%	0
International (not U.S. citizen or Permanent Resident)	4.5%	2
Mexican American, Chicano	0%	0
Native Hawaiian, Pacific Islander	0%	0
Puerto Rican	2.3%	1
White or Caucasian	81.8%	36
Other (please specify)	0%	0
Total Respondents	44	
(filtered out)		202
(skipped this question)		25

APPENDIX I – G

Assessment Feedback

3.) Exit Interviews

UMSL Program

Exit Interviews – May, 2002

Strengths: WU facilities, laboratories, faculty, advising (Dr. Bayly).
Weaknesses:

Exit Interviews – August, 2002

Strengths: educational opportunity in St. Louis at low tuition, advising.
Negatives: Scheduling- hard to be full-time, and Edgar needed to be full-time. Parking should start at 4:30 pm

Strengths: evening program opportunity, flexible for students who work during the day.
Weaknesses: Schedule-more regularity and more frequency of offerings.

Exit Interviews – January, 2003

Strengths: Faculty worked around students' schedules.
Weaknesses: Dearth of course offerings. Some courses are only offered once a year.
Bureaucracy: no problems.

Strengths: Versatility, flexibility, WU staff.
Weaknesses: rough transition to WU.
Bureaucracy: Changing advisers at WU.

Strengths: Evening schedule.
Weaknesses: courses should be offered more frequently.
Bureaucracy: no problems.

Strengths: Availability of WU laboratories.
Weaknesses: Lectures needed more examples of problems from the homework.
Bureaucracy: no problems.

Strengths: Faculty worked around students' schedules.
Weaknesses: Dearth of course offerings. Some courses are only offered once a year.
Bureaucracy: no problems.

Strengths: Evening option.
Weaknesses: Infrequent offering of classes.
Bureaucracy: no problems.

Strengths: In the evening. Large number of courses offered.
Weaknesses: Should be geared more toward non-traditional students as far as work loads.
Bureaucracy: Parking tickets at UMSL, but they were taken care of.
Strengths: Real-world experience of faculty.
Weaknesses: No adjustments for part-time, working students.
Bureaucracy: no problems.

Exit Interviews – May, 2003

Strengths: Great program for non-traditional students.

Weaknesses: Limited number of WU engineering courses.

Bureaucracy: Advising was “hit or miss.”.

Strengths: Flexible for working students.

Weaknesses: Lack of elective course choices in ME.

Bureaucracy: Wu parking tag not honored in the day at UMSL.

Exit Interviews – August, 2003

Strengths: Night schedule. Good program.

Weaknesses: None.

Bureaucracy: Location of parking sites at WU.

Strengths: Evening schedule.

Weaknesses: Accreditation.

Bureaucracy: None.

Strengths: Affordable in St. Louis. Easy to enroll.

Weaknesses: Dr. Bayly is a poor adviser- would not fight for students.

Bureaucracy: None.

UMSL ME Exit Interviews 2004-2005

August 2004

Strengths: Part-time structure.

Weaknesses: Scheduling.

Bureaucracy: UMSL students not treated as well as WU students.

Strengths: Cost, faculty.

Weaknesses: Evening schedule led to limited course offerings.

Bureaucracy: None.

Strengths: Evening program.

Weaknesses: Hardest classes in the summer.

Bureaucracy: WU was less flexible with UMSL students than with WU students.

December 2004

Strengths: Low tuition. Two campuses.

Weaknesses: Scheduling problems.

Bureaucracy: None.

May 2005

Strengths: Dr. Jerina. Instructors.

Weaknesses: Not enough hands on training.

Bureaucracy: None.

Strengths: Cost. Location.

Weaknesses: Two campuses have different schedules.

Bureaucracy: None.

EXIT INTERVIEWS SPRING 2005

Andrew Bugg ME Major, Dual Degree Student (5-20-05)

Concerned about grade inflation. Felt he received higher grades than deserved.

Had trouble in beginning of controls course figuring out why they were doing what they were doing.

A lot of time an effort goes into homework and it should be counted in the grade, even if some students are cheating. Suggests professors make up new problems.

Had trouble making conversion from MAPLE (in his old school) to MATLAB here.

Our new MAE 265 MATLAB course was very helpful, but should go a little slower at the beginning.

Dual degree students should be encouraged to take Materials Science early on.

Labs were very good, although some repeated things he had seen at old school.

Career center did a very good job in finding him a job.

Jonathan Mesh ME Major, AE minor (5-16-05)

He wishes we had had the AE major when he began.

ME 201, the Introduction to Aerospace, would be more valuable if taken after some of the other more basic courses were present.

His differential equation course was not good. Centered on computation and not basics.

The Introduction to MATLAB course was perfect for his needs.

Would like to see PRO-E instead of Solid-Edge as the modeling tool.

Controls started slow but improved towards the end. The Wright Flier example was helpful to see what the equations meant. Most had forgotten their circuits by the time they got to controls and had to relearn it. Homework due at end of class meant a lot of students were working on it during class and not listening.

Homework should count for points even if some cheat. The cheaters will pay for it on the exams.

Labs were very good and worked well.

Would like to see more opportunities to co-op and more practical examples in class.

David Levine ME major, AE minor (5-16-05)

We were not very helpful in getting him a co-op job.

The advising system is sub-par. Some faculty did not know names of their advisees, simply signed documents with no help or always referred all questions to Dr. Gardner. It was especially hard for someone in ROTC.

Would like more hands-on experience. For example, the reverse engineering in ME141C was good. The engine in propulsion was good, too.

Laboratories were good, but TA's set up equipment so that students do not really know how the sensors talk to the computer.

Fluids and Heat Transfer Laboratories good. It was fine having them in semester following course. It gave a chance to review course material.

Materials TA often just handed data sets to lab group with no experiments being done by the students! Lab courses generally ask for too much work given only one hour of credit. When possible, though, it would be good to have a Monday-Wednesday lecture followed by a Thursday lab (like ESE 102). That gives the best connection between classroom work and physics.

Homework needs to count for points. Many professors, like Axelbaum, wrote their own homework problems to reduce cheating.

ME 265 was a perfect course to teach MATLAB.

Charles Fourie ME Major, dual degree (5-12-05)

His college (Maryville) did not properly prepare him for WU.

The J-term was very helpful. Without that, he would have been sunk.

The first two semesters were very difficult.

ESE 317 was an excellent math course and gave him everything he needed.

He did C++ at Maryville, and it was no problem to transition to MATLAB.

The electronics course ESE 102 was very difficult. Too many details needed including MATLAB training before he had taken our ME 265 MATLAB course.

Our controls course ME 433, started out difficult, but now he sees where it was going and likes it.

Colin Lindsey Dual degree ME and BS-MS (5-16-05)

Students are too much on their own with placement service. They need to be pro-active. The co-op office was very good and easily helped him find a co-op. The seminars given by the placement office were good. More out-of-town companies needed.

Homework needs to count for a grade but limit it to a small percent due to widespread availability of solution manuals.

Controls course ended strong. The Final Project really helped in putting it all together. Controls could benefit from a Lab. Also, suggests having a section just for aerospace engineers and a different one for mechanical engineers.

Fluids and Heat transfer were good courses and good labs.

Vibration lab there was too much done for the student. Need more hands-on experience. Vibrations lab was good in how they ran sections around the clock to keep groups small.

Materials lab not good with six to seven people per lab group.

This student did not like the late afternoon hours for some of our electives.

Advising for BSMS students by their undergraduate advisors is lacking. BSMS need to get to MS advisor more quickly.

ME 417 and ME 522 have too much overlap when taught by the same instructor. Need to make them have only one or two weeks of overlap.

Scott Kaminski ME major, Dual Degree (5-17-05)

Experience at WU was very good.

ME 265 gave him good preparation for computing.

Labs need to be more hands-on. Students should be allowed to play around more.

Tests were very hard.

Job search was helped very much by placement service. They did a good job.

Homework should not be counted as part of grade because solutions are available from back files and solution manuals on e-bay.

His advisor at his previous university did not properly convey the requirements necessary for a dual degree student.

John Keplinger ME major (5-17-05)

Expectation were met in personal interactions with faculty at WU.

Although some classes were large (close to 50), he still felt he had adequate opportunity to speak with professors outside of class.

Some TA's did not have a very good command of English. Homework was sometimes graded yes or no without an explanation of what went wrong.

Homework should count as part of the grade or people will not do it. The counting gives motivation to do it. If some copy it, it is just hurting themselves.

The transition from C++ to MATLAB was easy.

Career services should give more options for out-of-town companies. The WU Alumni connections web site was very helpful.

In laboratories, TA's do too much of the work. An exception is Heat Transfer.

Brandon Larson Dual-Degree ME Major (5-16-05)

Too many people in each lab group in Fluids Lab.

Our Computer drawing course should have ATIA, AUTO-CAD, and PRO-E.

Had no trouble finding a job, but placement was not that much helped by Career Services.

Count homework as points. If people want to go to e-bay and cheat, too bad for them.

Would like to see more hands-on experience and more team experiences.

Asa Young ME major, Dual Degree

Transition was rough from a very small school with classes of 6 to WU. It was also tough coming into a situation where all I had were engineering courses.

Professors have good office hours and he always felt he could access them.

Mixed reviews on TA's. Some were good, some were not.

Computing preparation in ME MATLAB course was very adequate.

Career fairs were not nearly so good at his old school.

Fluids lab was very good. All labs good.

It was a shock for him to learn about back files and solution manuals. We should count homework as points but make up our own problems.

Controls course was very interesting and project helped to bring it all together.

He would like to see more exams in courses.

Overall, it was a great experience and he would do it again.

APPENDIX I – H

Assessment-induced examples of Changes Implemented

MEMO

To: All MAE full-time and part-time faculty
From: Dave Peters
Subject: Classroom etiquette
Date: April 12, 2004

I would like to remind everyone of a few unwritten rules of classes at WU.

1. All classes start at 7 minutes after the scheduled start time to give students a chance to get from one class to the next. Please honor this rule and do not start early (unless everyone is there).
2. All lectures need to end at or before the scheduled end time for the class (for the very same reason as stated above). Students and faculty should egress the room as soon as possible at the end of class to allow the new class time to ingress.
3. It is the normal custom to erase the board when you come into the class, rather than when you leave, since the beginning is the 7-minute time period that you will have as your own students enter. Thus, you do not need to feel guilty if you must leave notes on the board.

We do not do a very good job of communicating these rules to faculty when they come into the program, so I thought it might be good to remind everyone.

Date: Tue, 8 Feb 2005 16:34:36 -0500
To: ktrum@wustl.edu
From: David Peters <dap@me.wustl.edu>
Subject: CE231

Kevin:

At our ME retreat, we received a lot of feedback from those teaching Dynamics and Deformable Bodies (like Guy Genin, Barna Szabo, and Shawn Sellers) concernign what students know coming out of statics. It seems to them that, since you (personally) stopped teaching statics, the quality of those coming out of that course had gone down. The students do not know vector mechanics at all and cannot draw a shear or moment diagram.

We don't know if it is because the new instructors do not do as good of a job as you did, if the students are simply getting worse, if it is the presence of UMSL students in those sections that is watering down the course, or if we are just getting old a crabby. (We find that some of the UMSI students who are in Barna's Mechanics of Deformable Bodies have problems, and this is why the thought of UMSL pull-down came up.)

Do you have any idea on what we might be seeing? Are you seeing the same poor preparation in your classes? Do you have any ideas on anything that we can do that would help the situation? Anything we did would not only help the quality of the students coming out but would also be great fodder for ABET.

Dave

Subject: RE: CE231
Date: Tue, 8 Feb 2005 16:05:15 -0600
Thread-Topic: CE231
From: "Truman, Kevin" <KTrum@seas.wustl.edu>
To: "Peters, David A." <dap@me.wustl.edu>

One last thought, Judy Sawyer is having more of the Dual Degree students take Statics before they come which they should, but who knows where they are getting this course, junior colleges, independent studies at the liberal arts schools, physics profs at the liberal arts schools(have been told by many that they (LA physics profs) skip shear and bending moments.)

It is disappointing to hear that some of the students are struggling, but we will try to improve in the coming semesters.

kzt

Kevin Z. Truman, Ph.D.
Professor and Chair
Department of Civil Engineering
Washington University
Campus Box 1130
One Brookings Drive
St. Louis, MO 63130
(314) 935-6350

Date: Tue, 8 Feb 2005 16:59:08 -0500
To: "Truman, Kevin" <KTrum@seas.wustl.edu>
From: David Peters <dap@me.wustl.edu>
Subject: RE: CE231
Cc:
Bcc:
X-Attachments:

Kevin, thanks for your prompt reply. I will send those thoughts onto the instructors and we will watch to see if we see any change in the coming semesters.
Dave

Date: Mon, 16 May 2005 14:25:30 -0500
To: smls@me
From: David Peters <dap@me.wustl.edu>
Subject: Materials Lab
Cc:
Bcc:
X-Attachments:

Shankar:

I have been interviewing the exiting seniors about their experience here. One of the items that has come up with many of them has to do with the lab assistants in ME 325. Many people said that, when you were not there in the lab, the lab assistants mainly just tried to get rid of the students as soon as possible. There were instances of the assistant saying, "I have to study, so here are the data. Take them and write them up." Or, some others reported that a piece of equipment was broken so they were just handed data. Even when data were gathered in lab, the students said that (with 6 or 7 in a group) the TA took the data and handed it to them.

We have similar complaints about other labs, and I know that it will get worse in the Fall with the larger numbers. Still, I wanted to let you know so that you could give some instructions to the TA's about what to do and so you could supervise them a little more closely.

Thank you,
Dave

Date: Mon, 16 May 2005 14:20:23 -0500
To: pvb@me
From: David Peters <dap@me.wustl.edu>
Subject: Vibrations Lab
Cc:
Bcc:
X-Attachments:

Phil, I know that you have been out of the loop on vibration lab for quite a while.

I have been getting a lot of feedback from the Student advisory board and the exit interviews about the lab.

Most of the people like the lab and it compares favorably to other labs.

However, almost everyone feels that the TA does too much of the work for the students. Students feel like the TA just wants to get out of there as soon as possible and basically hands them the data. They also feel like they do not understand enough about how the data collection is done and how the transducers talk to the computer.

I will mention this to Antonio, but I wanted to let you know, too; since maybe you could have some impact on changing the culture.

To put this in perspective, these are just the negative comments. Everyone had many positive comments, as well.

Dave

CATALOGUE DESCRIPTION
MAE 265

This course provides Mechanical and Aerospace Engineering Students with the computational tools that will be needed in order to solve Mechanical and Aerospace Engineering problems both in the upper-level MAE curriculum and in many industrial applications that they may see upon graduation. These applications will include problems applicable to thermodynamics, fluid mechanics, heat transfer, automatic control, structural and stress analysis, and dynamics and vibrations. The primary computational tool will be MATLAB. MATLAB Basics will be treated including: matrices, data input/output, program flow control, functions, and graphics. Numerical tools to be covered are: systems of equations, interpolation and curve-fitting, nonlinear equations and optimization, finite-difference and numerical integration, eigenvalues, and initial-value problems. Each topic will be treated in four stages. First, each Mechanical or Aerospace Engineering problem will be introduced (along with the appropriate solution methodology). Second, the appropriate MATLAB Commands will be illustrated by applications to that problem. Third, students will be given hands-on exercises in class to work those problems themselves. Fourth, homework will be assigned for the students to do outside of class.

FEEDBACK ON COURSES

During the weeks of February 14-25, several students came in from MAE 433 Aircraft Stability and Control, complaining that they could not figure out what the course was about. They complained the instructor only followed the book line by line and that the book was terrible. Actually, the book is quite good and is already in its tenth edition. The instructor is also one of our good instructors. He took the information and went back to the class trying to give them a better feel for the reason that control is important. He put together some video of a fugoid mode on the Wright Flyer to show the class how aircraft instabilities can manifest themselves. We will now watch to see how this plays out through the rest of the year and look at the final evaluations.

David Peters
2-28-05

Date: Mon, 27 Feb 2006 10:59:36 -0600
To: Mark Jakiela <mjj@mecf.wustl.edu>
From: David Peters <dap@me.wustl.edu>
Subject: Undergraduate Advisory Board
Cc:
Bcc:
X-Attachments:

Dear Mark and Ruth:

Some items came up in our Undergraduate Advisory Board Meeting that involve the design sequence.

1.) The first one is that those in Senior Design feel that they do not have adequate access to the Jolley Computer Lab. With 5 sections of 141C and D, they are often kicked out of there. Because of the high-security access rules, they cannot go whenever they want to, and this is slowing down their senior projects. Is there a way that we can either schedule more time for our seniors or work out a buddy system where two students may gain access to the labs off hours?

2.) They asked if the patent search stuff could be put at the beginning of 141D, which they say is pretty light. This would free up more time for real Machine Design in the Junior Design Course. They pretty much all felt that they needed more hands-on machine design experience. Is this a possibility? Is it something that has any down-side?

3.) Once again, the students were adamant that they needed some course where they could learn PRO-E. Am I correct that we are now purchasing licenses for this? What will be the future of PRO-E in our curriculum?

Please convene the design faculty (if needed) and find out whether or not these are things we want to do, or will be doing so that I can report back to the students. This feedback mechanism will be documented for our ABET review in the Fall.

Dave

Date: Sun, 12 Mar 2006 22:10:11 -0600
Subject: Re: Undergraduate Advisory Board
From: Mark Jakiela <mjj@mecf.wustl.edu>
To: David Peters <dap@me.wustl.edu>
CC: <rjo@me.wustl.edu>, <mas@me.wustl.edu>, <jwc@me.wustl.edu>

Hello Dave and All:

Please find attached a writeup (Jakiela version) of possible responses to the issues below raised by the undergraduate advisory board.

I am very sorry this took two weeks to generate.

Regardless, please read it carefully, as I promise some things in there that I would not want later to be a surprise to anyone.

Feel free to edit and revise and pass versions around. I hope that I incorporated everyone's thoughts so far.

Thanks.

MJ

on 2/27/06 10:59 AM, David Peters at dap@me.wustl.edu wrote:

Dear Mark and Ruth:

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1.) The first one is that those in Senior Design feel that they do not have adequate access to the Jolley Computer Lab. With 5 sections of 141C and D, they are often kicked out of there. Because of the high-security access rules, they cannot go whenever they want to, and this is slowing down their senior projects. Is there a way that we can either schedule more time for our seniors or work out a buddy system where two students may gain access to the labs off hours?

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Please convene the design faculty (if needed) and find out whether or not these are things we want to do, or will be doing so that I can report back to the students. This feedback mechanism will be documented for our ABET review in the Fall.

Dave

[UGradAdvBdResponse.doc](#)

MEMO

To: MAE Undergraduate Advisory Board
From : Professor David Peters (Chair)

Date: March 13, 2006

RE: Design sequence issues.

Professor Peters reported to the design faculty that the following three issues related to the design sequence are of concern to the MAE Undergraduate Advisory Board. The issues are numbered and in italics. Thoughts in response to each issue, summarizing the thoughts of the design faculty immediately follow.

1. More access to Jolley 110 for MAE 404P prototype building.

A concern was that seniors do not have enough access to the 141D lab (Jolley 110), primarily due to the recent large enrollments in 141D requiring many sections. First, to clarify, Jolley 110 is intended to be dedicated to 141D: it is arranged to be a classroom as well as a very light duty workshop with tools appropriate only for specific materials (e.g. sheet metal, fume-cor, wood dowels, masonite, steel rod). It is inappropriate as a general workshop/prototyping space as it is too crowded with tables and chairs, and does not have some of the common workshop machine tools (e.g. no Bridgeport mill). As it is a teaching lab, graduate students should not use it to work on sponsored research projects and we cannot allow undergraduate students to use it unsupervised. We understand, however, that given that everyone takes 141D, the room is looked upon as a natural place to “hack” designs. In this regard, we are investigating the following:

- A. Pay competent graduate students to supervise the use of the room during times when 141D sections are not in session.
- B. Find other workshop and project storage space that would be dedicated to MAE 404P.
- C. Subsidize and supply individual toolboxes that students could purchase and keep. This would allow working on 404P projects in your own space.
- D. Rearrange the schedule of classes so that the Friday morning session of 141D does not conflict at all with the Friday sessions of 404P.

2. Cover intellectual property topics in 141D rather than MAE 322A.

An idea was proposed to cover intellectual property topics (related to design) in 141D rather than in 322A. Professor Jakiela, coordinating instructor for 322A, as well as the designer of the current 141D format, is (in a very friendly way) opposed to this and somewhat puzzled by it. He asks to meet with the board to learn more about how such a rearrangement of content would benefit either course. To possibly enhance such a meeting he does wish to remind the board members that the total content of 141D must be limited to 2 units. Additionally, an introduction to intellectual property issues related to mechanical design naturally falls within the “searching background information” step of the overall design process presented in 322A. This process is intended for so-called “real world” design problems, not the “dreamed up” design contests of 141D.

3. Teach ProE.

There seems to be a strong desire that we teach the ProEngineer modeling system. Although we do not endorse one CAD system over another, we have been using the SolidEdge/Unigraphics system because it has very powerful capabilities (particularly the Unigraphics modeler and associated engineering analysis subsystems), is often used in industry (e.g. Boeing), and is available to us at a low cost. Professor Craig has made ProE available on selected machines in the Graphics lab (Jolley basement), but he does not teach it. In response to this desire, we are investigating obtaining enough ProE seats (i.e. the cost) in order to begin teaching it, most likely in addition to SolidEdge/Unigraphics.

Date: Mon, 27 Feb 2006 11:40:58 -0600
To: aqshen-me, efried@me
From: David Peters <dap@me.wustl.edu>
Subject: Thermodynamics
Cc:
Bcc:
X-Attachments:

Dear Amy and Eliot:

Prof. Gardner, Jerina and I just had our Undergraduate Advisory Board Meeting with our best undergraduates. From them, we were able to obtain feedback for the past two years of for ME 320 Thermodynamics (as well as for all of our courses). Thus, I am sending emails like this one to many of our undergraduate faculty (both full-time and part-time).

I will share the thoughts of these students on ME 320 below. Some of these things you all know already, but some may be new. In any event, it is a very important part of our ABET review coming up this Fall that we can show that we listened to the students and make changes, when appropriate. Since Amy will be going up for tenure at some future date, it is also very important that we do things will help the teaching evaluations for her. Thus, there are several levels of importance to the comments (other than that they come from our top students). Here are the major items, and I would be happy to discuss any of them in more detail with you.

- 1.) As we suspected, last Fall's experiment did not prepare the students for ME 321 Energetics or for ME 488 Propulsion. Professors Dyer and Axelbaum have had to do remedial work to bring them up to where they can solve practical, engineering thermodynamics problems. Energetics starts with Chapter 11 of the textbook, but the students were not acquainted with the practical examples of the earlier chapters, and could not do the work. Of course, we already knew this; but this feedback reinforces our decision to go back to a more traditional approach.
- 2.) Many students, especially the Physics students in the Dual-Degree Program, truly appreciated the top-down approach you all took and thought it was great --- BUT they also say that it did not prepare them for the follow-on course. They needed more practical engineering examples. I think that this reinforces what we felt last semester. The new approach had some advantages, but they were outweighed by the practical considerations of Mechanical Engineers. Perhaps we need to think of giving our Graduate Engineering Course on Thermodynamics with the new approach. Then, we could offer a more top-down (rather than bottom-up) approach to thermo. For now, though, I think we need to keep ME 320 focused on practical problem-solving with a deeper understanding to come later.
- 3.) As a follow-up to item 2), there were comments on teaching that applied both to last Fall and to two years ago, as well. Even for two years ago with the old approach, students uniformly felt that the lecture style in both sections (and perhaps a little more in Dr. Shen's section) was mostly copying from the notes or the text onto the board and then reading them to the class. Their feeling was strong that students should be expected to read the material themselves. In class, they would rather see the material approached from a different approach (or elaborated upon) rather than mimicking the book. The strongest sentiment was that they would like to see many more practical examples worked in class. That is what will prepare them for the follow-on courses. We had this same

feedback from Dr. Chen's Fluid Mechanics a few years ago when he first taught it. He changed his style, and his the results were excellent. Not only did the class learn more, but his evaluations went up which was very helpful when we put him up for tenure.

The above are the major issues, and I would be interested in some feedback as to what you all think we can do in response to student input.

Dave

Subject: RE: Crisis in ME/CE 241
Date: Tue, 28 Feb 2006 09:10:15 -0600
From: "Kroeger, Chris" <ChrisKroeger@seas.wustl.edu>
To: "Peters, David A." <dap@me.wustl.edu>
Cc: "Osborn, Melanie" <osborn@seas.wustl.edu>, <Bill_Darby@aismail.wustl.edu>

Hi Dave,

By copy of this email, I'll ask Melanie to contact you directly and see how to best coordinate getting tutors for 241.

The best short-term idea does sound like having the Joint students take remedial statics classes during Spring break, before the exam. I'm sure if you contact Kim Shilling she could find some classroom space in one of our buildings during that week.

Long term - it might be helpful to teach a pre-statics course. It could even be taught for independent study credit if we don't want to create a special course for it.

I apologize in advance for my spotty availability and response time this week. I'm on the committee interviewing dean candidates, and we are meeting with all nine candidates this week.

Chris

From: Bill_Darby@aismail.wustl.edu [mailto:Bill_Darby@aismail.wustl.edu]
Sent: Tuesday, February 28, 2006 12:12 AM
To: Peters, David A.
Cc: Kroeger, Chris; Melanie Osborn
Subject: Re: Crisis in ME/CE 241

Dear Dave,

First and foremost, let's keep Bernard out of this for a while. Rolla is getting ready for another attack and we don't want to provide them with additional ammunition.

I'm in South Africa and my only e-mail access is via the BlackBerry. Thus, I really can't wade through a ten-year history of this course or try to develop a long-term solution under these circumstances.

In the short run, I'm copying Chris Kroeger and Melanie Osborn in the hope that they can help in arranging additional help sessions and tutoring.

We can NOT turn this back to UM-St. Louis and ask them to arrange remedial sessions. This -- in the short run -- is our problem.

Best,
Bill

----- Original Message -----

From: David Peters [dap@me.wustl.edu]
Sent: 02/27/2006 06:24 PM
To: Darby, Bill" <darby@seas.wustl.edu>
Subject: Crisis in ME/CE 241

Dear Bill:

We have a crisis in our ME/CE 241 Mechanics of Deformable Bodies this Spring. The bottom line is that 15 UMSL students may fail. We need a short-term solution for this semester and a long-term solution for future semesters. I, Ken Jerina, Barna Szabo, and Ricardo Actis met

this afternoon and discussed it. We have some ideas, but want to run them by you before I go to Bernard.

First, let's start with the background. In Fall, Prof. Szabo teaches 241, and he has only WU students. In Spring, Prof. Actis teaches it; and it has both WU and UMSL co-mingled. There are both ME's and CE's in the course. (Prof. Actis is one of our best teachers and has wonderful teaching evaluations. He also teaches our Aerospace Structures course.) The mixture of WU and UMSL students since Dr. Actis has been teaching ME/CE 241 is as follows:

<u>Years</u>	<u>average WU/year</u>	<u>average UMSL/year</u>
95-97	15	11
98-00	15	17
01-03	13	21
04-06	25	27

You can see that the number of UMSL students has been growing. This semester, we have 22 WU students and 31 UMSL. Below are the average final grade point averages in the past Spring semesters for WU and UMSL students.

<u>Year</u>	<u>WU</u>	<u>UMSL</u>	<u>DELTA</u>	<u>F's among WU</u>	<u>F's among UMSL</u>
1995	2.67	2.67	.00	0	0
1996	3.00	2.57	.43	0	0
1997	2.30	2.25	.05	0	0
1998	3.36	2.35	1.01	0	0
1999	2.64	2.00	.64	0	1
2000	2.70	2.33	.37	0	0
2001	3.11	3.00	.11	0	0
2002	2.63	1.89	.74	0	2
2003	3.00	1.46	1.54	2	4
2004	2.93	1.52	1.41	1	7
2005	3.20	1.68	1.52	0	5

You can see that, while the WU grades are fairly uniform, the UMSL grades have been dropping, especially over the past four years. Thus, even before this year, a crisis was emerging. The problem was (and still is) that the students in UMSL are not adequately prepared in statics. You may recall that we mentioned this to you and Bernard and talked about ways of alleviating the problem by putting a tighter reign on statics and talking to Junior Colleges about what we needed in Statics. I think that I have dropped the ball on this one.

This year, the situation has come to a crisis. After the first quiz, the WU average (22 students) was 80% with the two lowest grades being 40%. The average for the UMSL group (32 students) was 46% with 19 students scoring in the 20% - 50% bracket. By extrapolation, this would mean that we will have 15 F's in the course. Of course, there are a few UMSL students doing very well, and a few WU students doing very poorly; but the statistics (contrary to Mark Twain) don't lie.

Dr. Actis identified the problem very early this Spring by a pre-exam homework problem to test their mastery of Statics. The WU average was 90% and the UMSL average was 38%. Therefore, from early in the term, Dr. Actis has been staying after class from 1.5 to 2.0 hours per night with those needing remedial Statics. Besides this, the grader has been running a third help session. The poorer students are coming to these help sessions; but, based on the quiz results, these help sessions have not been enough to alleviate the basic lack of preparation. Dr. Actis says that there are many in the class whom if he gives a completely worked out problem and then asks them to work the identical problem with different numerical values, still cannot do it. This is the problem we are up against.

The midterm is right after Spring Break, and Dr. Actis is running help sessions on Tuesday and Thursday from 5:30 - 7:00 but it is doubtful that this will be enough. The sessions will mainly be

on material covered in deformable bodies, not on remedial Statics. Therefore, this is what we are proposing:

SHORT TERM: The only short-term solution we can see is as follows:

- 1.) Have UMSL set up some remedial statics J-term classes during Spring break, before the exam.
- 2.) Allow us to issue mid-term grades after the mid-term so that students will have an idea of whether or not they should drop the course. For some, this is the only option.

LONG TERM: Of course we need to address this in the long term. Below are some ideas.

- 1.) We need set up some serious filters on Statics or else give J-term Statics refreshers.
- 2.) We should set up the class as MWF or TuThF 5:30 -7:00 with the Friday slot set aside for extra quizzes and extra help sessions in Statics.

Let me know how you feel about all of this and how we should approach Bernard. Spring break is only 2 weeks away, so we need to act quickly.

Dave

Date: Wed, 1 Mar 2006 12:26:00 -0600 (CST)
From: "Jerry W. Craig" <jwc@mecf.wustl.edu>
To: Mark Jakiela <mjj@mecf.wustl.edu>
cc: David Peters <dap@me.wustl.edu>, rjo@me.wustl.edu, mas@me.wustl.edu,
jwc@me.wustl.edu
Subject: Re: Undergraduate Advisory Board

I can get free anytime for a meeting. - Jerry Craig

RE: #1 Students have free access to Jolley 2 anytime by using the combination lock on the door.

We have never "kicked out" anyone from the lab. Students may show up and see a class in session. The only times the lab is completely full is 2:30 Mon/Wed and 5:30 Tue/Thur. Lab is totally free Fridays and weekends.

All the times Jolley 2 is used, Sever 203 is open.

#3 I purchased personal copies of "Inventor", "Pro-Engineer", "Turbo CAD/CAM" and "SolidWorks" and installed on various computers in Jolley 2. There are signs on each computer. Unigraphics, Solid Edge, IronCAD and SketchUP are installed on all computers in Jolley 2.

Jerry Craig

On Tue, 28 Feb 2006, Mark Jakiela wrote:

Hello All:

Ruth, Mike, and Jerry:

Are you guys available to meet sometime in the afternoon of Wed 3/1?

Jerry: including you because most of the issues below involve the 141C lab.

Thanks. Will check email in the morning.

MJ

on 2/27/06 10:59 AM, David Peters at dap@me.wustl.edu wrote:

Dear Mark and Ruth:

Some items came up in our Undergraduate Advisory Board Meeting that involve the design sequence.

1.) The first one is that those in Senior Design feel that they do not have adequate access to the Jolley Computer Lab. With 5 sections of 141C and D, they are often kicked out of there. Because of the high-security access rules, they cannot go whenever they want to, and this is slowing down their senior projects. Is there a way that we can either schedule more time for our seniors or work out a buddy system where two students may gain access to the labs off hours?

2.) They asked if the patent search stuff could be put at the beginning of 141D, which they say is pretty light. This would free up more time for real Machine Design in the Junior Design Course.

They pretty much all felt that they needed more hands-on machine design experience. Is this a possibility? Is it something that has any down-side?

3.) Once again, the students were adamant that they needed some course where they could learn PRO-E. Am I correct that we are now purchasing licenses for this? What will be the future of PRO-E in our curriculum?

Please convene the design faculty (if needed) and find out whether or not these are things we want to do, or will be doing so that I can report back to the students. This feedback mechanism will be documented for our ABET review in the Fall.

Dave

APPENDIX I – I

Course File Collection