College of Engineering Curriculum Committee (2005-06)
Final Report

Members	Term Expiring
Prof. William Eichinger, CEE, Chair	May 2006
Prof. Michael Mackey	May 2008
Prof. Tom Schnell, IE	May 2006
Prof. Dave Rethwisch, CBE	May 2007
Prof. Er-Wei Bai, ECE	May 2007
Nicole Heacock, nonvoting	May 2006
Dean Alec Scranton, *ex officio* and nonvoting	

General

The Curriculum Committee (CC) met a total of 6 times. The Charges provided by EFC were divided among CC members to investigate and develop responses. The description that follows summarizes the Charges, actions taken, and, where appropriate, recommendations to EFC.

General Charge

The Curriculum Committee shall be responsible for reviewing and evaluating all existing and any proposed curricula within the college, for reviewing and evaluating all existing and any proposed courses taught within the college or required in any of its curricula, and for making appropriate recommendations to the dean and the faculty.

Specific Charges

1. In follow-up to the plan developed by last year's Curriculum Committee and considering the information provided by the EFC, develop a policy, and a plan for its efficient and effective implementation, for incorporating global awareness into the curriculum. The goal is to ensure that all students attain the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

This effort was delayed pending a review by the Dean's office of the implementation of Global Awareness requirements in the curriculum of other engineering colleges. After receiving the report from Megan , the committee met several times to consider alternatives. The committee submitted a proposal to the EFC which was not adopted. A copy of the plan is attached at Appendix A.

2. Participate in the Professionalism, Ethics and Leadership in Engineering Education Initiative. Contribute as requested to the deliberations of the Professionalism, Ethics and Leadership Task Force.

3. Review Course Activity Reports (CAR) for the College of Engineering core curriculum courses (59:xxx & non-college courses). Submit an evaluation to the Engineering Faculty

Council (EFC) of how well the assessment process for the core is working. If the Curriculum Committee identifies specific problems that need addressing, either with the overall process or with individual courses, report these to the EFC.

Subcommittee Assignment: Dave Rethwisch and Nicole Heacock.

The available CARs for the past several years were examined for evidence of identification of problems and the implementation of corrective measures. As a rule, the method as implemented appears to accomplish the goal of continual course improvement. A number of particular complaints were discussed in detail by the committee. Most are complaints inherent to the types of courses taught in the college (projects that occur near the end of the semester). Recurring complaints concerning the use of computer software in Engineering Fundamentals III: Thermodynamics and Engineering Fundamentals II: Electrical Circuits courses were noted. On behalf of the committee, the chair has written letters to the course coordinators outlining the problem and asking them to address the problems in upcoming semesters.

4. Monitor the results of the ongoing assessment of the math sequence being performed by the College of Engineering Office of the Dean.

Subcommittee Assignment: Bill Eichinger and Alec Scranton

In the spring of 2005, the Alec Scranton and Madhavan Raghavan identified the specific math skills taught within the four math courses in the required sequence.. Appendix B provides a list of the topics within each math course from which a set of skills were identified. They also identified the courses and instructors that were polled. Appendix C shows the results of this polling. A simple chart shows graphically the comparison of the relative importance assigned to a given skill with the assessment of students abilities in that skill. Any skills that fall in the region to the right and below the 1:1 line indicate a substandard mismatch between the needs of the curriculum and the students abilities. This polling is intended to be recurring, another being scheduled for the fall semester of 2006.

5. Recommend specific charges for the 2006-07 Curriculum Committee.

The Charges for the 2006-2007 Curriculum Committee should include:

** Participation in the Professionalism, Ethics and Leadership in Engineering Education Initiative.*

** Development of a plan that will enhance the global awareness of our engineering students for consideration by the faculty.*

** Continuation of the monitoring of CARs for the core curriculum.*

6. Submit an interim report by January 17, 2006, and final report by May 31, 2006.

The final report was provided to EFC

CoE Curriculum Committee
May 3, 2006

APPENDIX A - Charge 1 : Global Awareness

Charge

Monitor the results of the ongoing assessment of the math sequence being performed by the College of Engineering Office of the Dean.

Philosophy

Graduate will have an education that is supportive of a broad awareness of the diversity of the world and its culture, and that provides an understanding of the impact of engineering practice in the global community.

Goals

- Gain an understanding and appreciation of engineering standard, infrastructure, and resource constraints in other countries.
- Develop interpersonal skills to work with people effectively from different countries.
- Understand and learn to work with cultural, social, political and economical differences on engineering practice in other countries.

The Plan

An Approved 3-SH course with global content focus (defined at the college level)	**An Approved Student proposed effort with a global theme.**
2 lectures with global content focus taken during the Professional Seminar	

Explanation

a) The Plan consists of 2 parts:

- 2 mandatory lectures relating to global business and engineering practices to be taken in the Professional Seminar class.
- 1 approved 3-SH course with a global focus will be taken by each student. The 3-SH course will be taken as part of the GEC requirement and may be selected from an approved list maintained by the College. Alternately, this requirement may be satisfied by an approved student effort with a global theme. An approved student effort must have substantial global awareness content and might be a special project, an internship at an appropriate facility or company or a semester of study abroad. Substitutions for the 3 SH requirement will be approved at the departmental level.

b) The student's Degree Evaluation form will have an item on Global Awareness. The item will be checked once the requirement is fulfilled.

c) We anticipate that the mandatory lectures will be all-College seminars sponsored by the College and will substitute for one of the weekly Professional Seminars.

APPENDIX B - Charge 4: Assessment of Math Skills

Charge

Establish appropriate learning goals and develop a plan that will enhance the global awareness of CoE students. As appropriate, develop a motion for consideration by the faculty to implement the plan

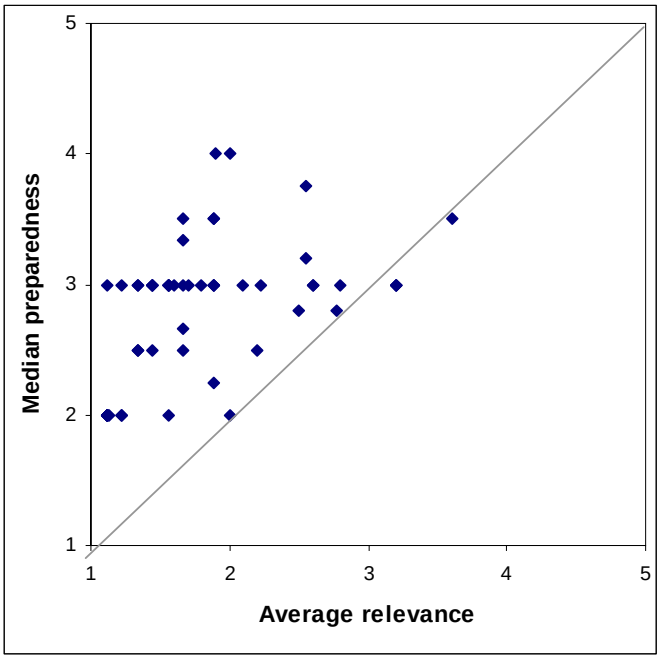
Survey

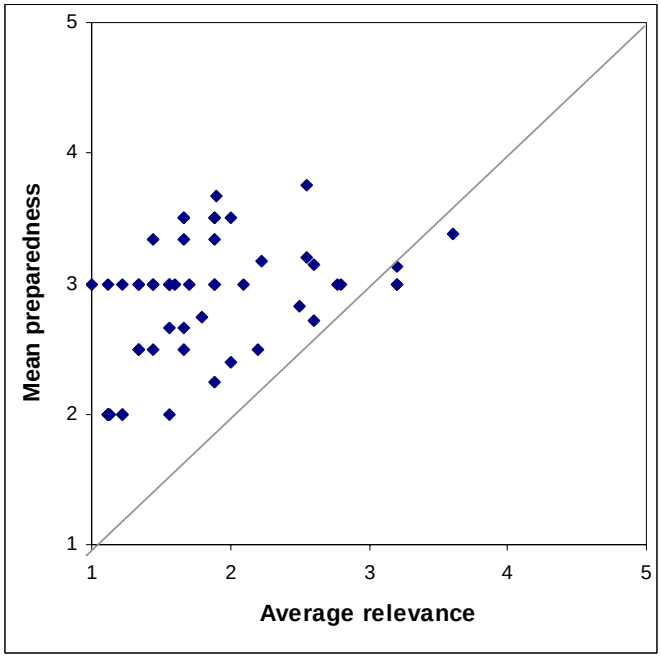
• The core math courses were assessed based upon the course topic list (these lists were adopted by the engineering faculty during the last curriculum change). For each course topic, the faculty of the selected engineering courses were polled regarding: 1) the relevance of math topic to the instructor's course; and 2) the students' knowledge and understanding of the math topic as demonstrated in the instructor's course. The questionnaire containing the topic list for each math course is provided as Attachment I.

•The engineering courses whose instructors were polled was based upon the following criteria: 1) ~3 courses included from each of the six undergraduate programs; 2) the courses should be required for all students in the program; 3) must be a junior/senior level course in recommended 4-year curriculum. Based upon these principles, the list of selected courses for the first implementation of the process is provided as Attachment II.

Results

The results in graphic form can be seen below. Points below and to the right of the 1:1 line indicate student performance lower than expectations. While there are some points below the line, they are located quite close to the 1:1 line and well within the likely margin of error for a small sample size. Note that many of the points are significantly above the line, indicating a level of mastery of the skill beyond that which is required..





Attachment I

Core Math Course: 22M:031 Single Variable Calculus	Topics covered during class	Relevance to course (0 to 10)	Student preparedness (0 to 10)
1)	Pre-calculus: absolute value, intervals, lines, functions and their graphs including trig and inverse trig functions, exponential and log, base e and natural log.		
2)	Limits: Definition (intuitive, geometric and epsilon-delta). Limit theorems and their use. One sided limits and limits at infinity.		
3)	Continuity and introduction to the derivative; define point-wise continuity and continuity on an interval; state and explain intermediate value theorem and extreme value theorem; define derivative of a function at a point and connect to slopes of tangent lines and instantaneous rates of change.		
4)	Differentiation techniques, products, quotients, chain-rule		
5)	Derivatives of trig functions, inverse trig functions, exponential and log functions		
6)	Applications of derivative, implicit differentiation, related rates, differentials and tangent line approximation.		
7)	Max-Min and the Mean-Value Theorems, absolute max-min of continuous function on a closed bounded interval, critical points, endpoints, increasing and decreasing functions, the mean value theorem, relative max/min, first derivative test and some applied max-min problems		
8)	Taylor polynomials and the remainder; extend the Mean-Value Theorem to approximate and estimate error.		
9)	Graphing concavity, second derivative test, curve-sketching		
10)	Exponential growth and decay; L'Hospital's rule; graphs involving log and exponential functions.		
11)	Definite Integral and Fundamental Theorem of Calculus; definition of definite integral via Riemann sums, properties, relate to anti-derivative via the Fundamental Theorem.		
12)	Techniques of integration; standard rules for anti-differentiation and use of substitution		

13)	More techniques of integration include integration by parts and partial fractions		
14)	Improper integrals and numerical integration		
15)	Area and volumes of revolution		

Core Math Course: 22M:032 Multivariable Calculus	Topics covered during class	Relevance to course (0 to 10)	Student preparedness (0 to 10)
1)	Explicit, implicit, parametric equations for curves, including lines, circles, ellipses, and parabolas.		
2)	Vector geometry addition, scalar multiple, dot product, projections and angles, cross product. (postpone determinants and oriented areas and volumes until later in the course)		
3)	Functions of several variables (include polar/cylindrical coordinates)		
4)	Partial derivatives, directional derivatives, differential		
5)	Tangents lines and planes, relation to gradient vector		
6)	Maxima and minima		
7)	Applications of MAX-MIN		
8)	Multiple integrals in 2-dimensions		
9)	Multiple integrals in 3-dimensions (somewhere in 2- and 3- dim integrals, do polar/cylindrical coordinates; this means confronting “change of variable” “stretching factor” in some form)		
10)	Parametric curves, velocity, curvature		
11)	Vector fields and flows		
12)	Integration on curves (work integrals)		

Core Math Course: 22M:033 Matrix Algebra	Topics covered during class	Relevance to course (0 to 10)	Student preparedness (0 to 10)
1)	Matrix arithmetic: addition, multiplication, properties		
2)	Vectors: addition, scalar multiplication - algebraic and geometric		
3)	Linear combinations, linear independence, basis subspace - examples from R2 and R3		
4)	Reduced row echelon form of a matrix; calculation by hand and with computer		

5)	Solving linear systems and finding bases for row space and column space of matrix		
6)	Inverse of an nxn matrix: existence; calculate by hand and with computer		
7)	Use of inverse in solving systems of equations. Rank and dimension		
8)	Null Space; solution of Ax=0; General solution of Ax=b		
9)	Determinants; definition and properties; calculate by hand (row reduction) and computer; Expansion by minors (Laplace expansion of determinant)		
10)	Applications of determinants: Cramer's rule; cross- product.		
11)	Eigenvalues and eigenvectors: linear transformation; eigen-value, -vector, - space and examples		
12)	Diagonalization: P-1AP=D, where columns of P are basis for Rn consisting of eigenvectors of A, and D is a diagonal matrix of eigenvalues of A. Examples of diagonalization		
13)	Orthogonal bases: calculation by hand and by computer; Orthogonal diagonalization of symmetric matrix: principal axis theorem; calculation by hand and by computer.		
14)	Fitting a line or curve to data: Vandermonde matrices; least squares fittings.		
15)	Projection in R2 and R3: projecting a vector on a line and into a plane		
16)	Orthogonal matrices in R2 and R3: Applications of principal axis theorem		
17)	Rotations and reflections in R2 and R3		
18)	Exams, review/practice		

Core Math Course: 22M:034 Differential Equations	Topics covered during class	Relevance to course (0 to 10)	Student preparedness (0 to 10)
1)	Classification of differential equations; direction fields		
2)	Exponential growth and decay; related physical phenomena		
3)	Linear equations and integrating factors		
4)	Separable equations		
5)	Reduction of order, application of nonlinear equations: Bernoulli and logistic equations, gravitation		

6)	Sample computer lab assignment: direction fields; integration and differentiation; solution of first-order differential equations and initial value problems. Mechanical and electrical oscillation: modeling by initial value problems		
7)	Linear, constant-coefficient second order equations: homogeneous case; the characteristic polynomial		
8)	The method of undetermined coefficients		
9)	Oscillation and resonance (plus amplitude modulation and other phenomena)		
10)	The Laplace transform L; definition and foundations; some table entries; 1st differentiation rule		
11)	Solving initial value problems using Laplace and inverse Laplace		
12)	Sample computer assignment: Laplace transform (beyond constantcoefficient equations and beyond the familiar table entries); undetermined coefficients; amplitude modulation.		
13)	More on the Laplace transform: 1st and 2nd shift rules, 2nd differentiation rule, discontinuous inputs, periodic functions, impulse functions, convolution, impulse response, transfer function		
14)	Linearity; the Wronskian		
15)	Use of a known homogeneous solution to find another; variation of parameters		
16)	Topics chosen from: (I) Systems: generalities, reduction of higher-order equations to first-order systems. (II) Linear systems: homogeneous with constant coefficients; eigenvalues; the cases of complex and repeated eigenvalues; non-homogeneous systems; simultaneous differential equations. (III) Brief introduction to nonlinear second-order equations and first-order systems; phase plane and energy methods; the pendulum; predator-prey and competing species; nonlinear oscillators; autonomous systems and stability		

Engineering Courses Whose Instructors were Polled

BME
51:040 Biological Systems Analysis I
51:050 Biomechanics
51:060 Fundamentals of Biomedical Imaging

CBE
52:161 Mass Transfer and Separation
52:171 Thermodynamics/Transport lab
52:185 Process Dynamics/Control Design

CEE
53:033 Principles of structural Engineering
53:050 Natural Environmental Systems
53:063 Principles of Transport Engineering

ECE
55:032 Intro to Digital Design
55:040 Linear Systems
55:070 Electromagnetic Theory

MIE (Industrial)
56:032 Design for Manufacturing
56:134 Process Engineering
56:144 Human Factors

MIE (Mechanical)
58:048 Energy Systems Design
58:055 Mechanical Systems Ddesign
58:080 Experimental Engineering