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Proposal for Revising the General Education Component of Engineering Undergraduate Curricula

To

Council on Academic Affairs

From

Core Curriculum and Undergraduate Services Committee, College of Engineering

Through

College Committee on Academic Affairs, College of Engineering

Endorsements:

_____

Chair, Core Curriculum and Undergraduate Services Committee Date

_____

Chair, College Committee on Academic Affairs Date

_____

Dean, College of Engineering Date

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Executive Summary

The work and final report of the Undergraduate Curriculum Review Committee (UCRC) in June, 2002, established a framework for changes in general education at The Ohio State University. After a review of the UCRC report and our own outcomes assessment data, and with concurrence of the College Committee on Academic Affairs, the College of Engineering's Core Curriculum and Undergraduate Services Committee—known as the Core Committee—decided it was most timely to make the review and redevelopment of the model for general education in the College of Engineering (the Engineering GEC) its main focus for the academic year 2002-2003. This would be the next element in continuous quality improvement of the engineering undergraduate curriculum.

In addition to the UCRC report, the Core Committee reviewed a recent white paper on liberal education in engineering (Steneck, et al., 2002) published by the American Society for Engineering Education (ASEE) and other literature on general education, as well as outcomes assessment reports of the college for the past four years. The committee also collected data on liberal education from twelve benchmark institutions and on the patterns of courses taken by recent graduates. A liaison was assigned to the committee from the Colleges of the Arts and Sciences Curriculum Committee.

Based on these inputs, goals, consultation with other units, and extensive discussion, the committee developed a proposed model Engineering GEC and seven accompanying recommendations. Contingent on approval by the Council on Academic Affairs, implementation of this curriculum change is planned for Autumn Quarter, 2005. Table ES-1 summarizes the proposed and current Engineering GEC Requirements. There is a one course reduction across the combination of Categories of Social Sciences, Arts and Humanities with the addition of Ethics and Professionalism. Credits in the category of LA-GEC (see Table 3.2) would be reduced from 38 to 35 with a corresponding reduction in % LA-GEC from 19 % to 18 %. This would still leave the OSU Engineering GEC model above the mean of other comparable engineering curriculums for both course credits and % LA in the GEC. When approved, this proposal will result in a reduction of three credits to degree for all engineering students.

Table ES-1 Proposed and Current Engineering GEC Models	
Proposed Model	**Current Model**
English & Communications Skills A. First Course – English 110 (5 hrs) B. Second Course (5 hrs) C. Third Course (major department)	English & Communications Skills A. First Course – English 110 (5 hrs) B. Second Course (5 hrs) C. Third Course (major department)
Foreign Language(waived, may substitute up to 2 courses, 104 level or above, for Arts and Humanities and Social Science. See Rec. 2 for details.)	Foreign Language (waived)
Diversity Experience (0 hrs)	Social Diversity in the U. S. (0 hrs)
Social Sciences (10 hrs - selected from two groups) A. Individual and Groups B. Organizations and Polities C. Human, Natural, and Economic Resources	Social Sciences (9 hrs - selected from two groups) A. Individual and Groups B. Organizations and Polities C. Human, Natural and Economic Resources
Arts and Humanities (10 hrs - one from each group) A. Analysis of Texts and Works of Art (Literature, Visual/Performing Arts, Cultures and Ideas) B. Historical Survey	Arts and Humanities (9 hrs) A. Literature (5 hrs) B. Visual/Performing Arts and other Arts and Humanities (4 hrs)
	Historical Survey (10 hrs)
Ethics and Professionalism (5 hrs – selected from approved list)	
University Capstone (waived - may substitute for 5 hrs Social Science)	University Capstone (waived)
Quantitative Analysis (20 hrs) Math 151,152,153,254	Quantitative Analysis (20 hrs) Math 151,152,153,254
Natural Science and Technology (23 hrs) A. Chemistry 121 B. Physics 131,132 C. Additional Science (one course from approved list) D. Engineering 181	Natural Science (20 hrs) A. Chemistry 121 B. Physics 131,132 C. Additional Science (one course from approved list)
Total = 78 hrs	Total = 78 hrs

1 Introduction

The work and final report of the Undergraduate Curriculum Review Committee (UCRC) in June, 2002, established a framework for changes in general education at The Ohio State University. After a review of the UCRC report and our own outcomes assessment data, and with concurrence of the College Committee on Academic Affairs, the College of Engineering's Core Curriculum and Undergraduate Services Committee—known as the Core Committee (see Appendix 1 for membership)—decided it was most timely to make the review and redevelopment of the model for general education in the College of Engineering (the Engineering GEC) its main focus for the academic year 2002-2003. This would be the next element in continuous quality improvement of the engineering undergraduate curriculum.

In recognition of Faculty Rule 3335-5-26—which states that the jurisdiction for basic education requirements for colleges other than within the Colleges of the Arts and Sciences lies with the University Senate through the Council on Academic Affairs (CAA) and that the Colleges of Arts and Sciences have joint responsibility for planning for other colleges on a cooperative basis—the committee contacted the Executive Dean of the Colleges of the Arts and Sciences. As a result, a representative of the Arts and Sciences Curriculum Committee was assigned the position of liaison to the Core Committee for this effort.

In addition to the UCRC report, the Core Committee reviewed a recent white paper on liberal education in engineering (Steneck, et al., 2002) published by the American Society for Engineering Education (ASEE) and other literature on general education, as well as outcomes assessment reports of the college for the past four years. The committee also collected data on liberal education from twelve benchmark institutions and on the patterns of courses taken by recent graduates.

Guidelines set by the committee for reframing the Engineering GEC were

- Not increasing the number of credit hours to the degree,
- Staying within the construct of the GEC model established by the Colleges of the Arts and Sciences,
- Focusing curriculum choices to be consistent with the objectives and needs of engineers,
- Increasing the range of student choice consistent with objectives of the curriculum at large,
- Not disadvantaging students who may transfer out of engineering to other programs, and
- Being consistent with engineering programs of peer institutions.

The current curriculum elements for the Engineering GEC was established and approved by the Council on Academic Affairs in 1987 and has remained unchanged since that time. The Core Committee is responsible for overseeing the Engineering GEC and the engineering core curriculum. In 2001, a substantial change in the engineering core

curriculum of the college was implemented. Changes in the program specific requirements evolve on an on-going basis.

2 Background

2.1 Accreditation

Eight criteria for accrediting undergraduate engineering programs have been established by the Accreditation Board for Engineering and Technology (ABET, see Appendix 2). In accordance with the ABET General Criteria (ABET, 2001),

"programs must demonstrate that their graduates have:

(a) an ability to apply knowledge of mathematics, science, and engineering;
(b) an ability to design and conduct experiments, as well as to analyze and interpret data;
(c) an ability to design a system, component, or process to meet desired needs;
(d) an ability to function on multi-disciplinary teams;
(e) an ability to identify, formulate, and solve engineering problems;
(f) an understanding of professional and ethical responsibility;
(g) an ability to communicate effectively;
(h) the broad education necessary to understand the impact of engineering solutions in a global 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; and
(k) an ability to use the techniques, skills, and modem engineering tools necessary for engineering practice."

ABET also specifies a criterion for a Professional Component that requires specific subject areas appropriate to engineering but does not prescribe specific courses. This "component must include:

(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline;
(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study; and
(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives."

2.2 Structure of the Engineering Curriculum

The College of Engineering supports 16 separate undergraduate engineering degree programs (tagged degrees in that each degree is named Bachelor of Science in the degree program name) with 14 of the programs being accredited by ABET. The curriculum model for all programs comprises three overlapping and complementary elements as illustrated in Figure 2.1: (1) general education curriculum, (2) engineering core curriculum, and (3) major-specific curriculum. Each program is guided by the university's goals for an educated person and its general education goals (together known as university-level goals), accreditation outcomes (college-level criteria set forth by ABET, and degree-specific goals (ABET's program goals).

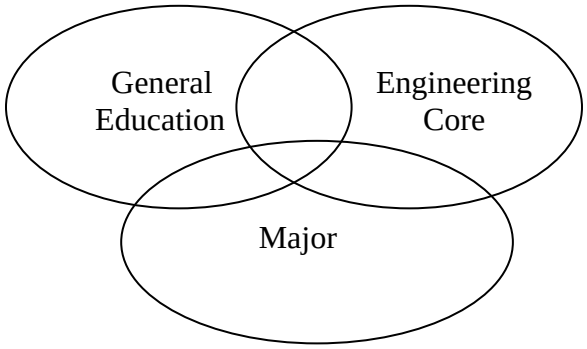

Figure 2.1 Curriculum Model for Engineering

2.2.1 The Engineering Core Curriculum.

The current Engineering Core requirement for all engineering programs was approved for implementation for students entering Autumn Quarter, 2001. This curriculum model comprises two elements. The first element, the Central Core, consists of the specific courses in English, mathematics, chemistry, physics, and engineering required of all students:

Central Core Courses
Composition (English 110*) – 5 credits
Introduction to Engineering I and II (ENGINEER 181 and 183) - 6 credits
Physics (Physics 131*,132*) – 10 credits
Chemistry (Chemistry 121*) – 5 credits
Mathematics (Math 151*,152*,153*,254*) – 20 credits
*Course currently approved for GEC credit

The second element of the Engineering Core, the Selected Core, allows programs to specify a selection of topics spread out between three broad subsections (Additional Science, Mathematics and Statistics, and General Engineering) totaling nine courses with a minimum of 27 credits. This allows programs flexibility to tailor each student's curriculum within a system that still assures reasonable breadth in engineering. One of the significant features of the currently-approved Engineering Core is the substitution of the Introduction to Engineering course sequence (ENGINEER 181 and 183) for Engineering Graphics 166. These courses introduce engineering "up front" in the curriculum during the first-year of study. Plus, a significant portion of these two courses focuses on written and oral communications, teamwork, and ethics, areas also of importance in general education and meeting ABET criteria.

2.2.2 The General Education Curriculum

As described in Section 1, the General Education Curriculum (GEC) follows a model approved by the Council on Academic Affairs in 1987 following the development of the Engineering GEC and the transition from the previous Basic Education Requirements (BER) model. The Engineering GEC model makes use of a somewhat modified version of the GEC model developed by the Colleges of the Arts and Sciences (ASC). By the

very nature of the programs, requirements for Quantitative Analysis and Natural Sciences go well beyond that of the ASC GEC model.

Courses approved for each category are listed in Appendix 3, a handout given to all students entering the college.

2.2.3 Major-specific Curricula

Major-specific requirements make up the remainder of the overall undergraduate curricula. These requirements must include elements designed to meet the ABET objectives of the program and must, by ABET requirements, include a capstone design experience.

2.2.4 Total Credit-Hours Required

Total credits required for engineering degrees varies by program, and in some cases options within a program, from 189 to 200 credits (Average = 196). The subdivision of the engineering curricula by major as presented in Table II – Degree Requirements by Major Within College/School of the UCRC Report is shown below as Table 2.1. In this case, the Engineering core element of the curriculum is divided such that 35 hours of math and science are allocated to the GEC and the remainder to the Major and Technical Electives.

Table 2.1 Degree Requirements by Major
(subset of Table III from the UCRC Report)

ENG (all BS in Eng)	GEC Hrs.	Prereq	Major	Tech. Elect	Free Elect	Total*
Aero & Astro	73		99	9		189
Aviation	78		67	40	3	190
Ceramic	76		103	12		195
Chemical	73		103	18		200-201
Civil	73		70	27		200
Computer Science	79		87	23		196
Electrical & Computer	76		76	43-49		199
Environmental	73		70	27		200
Engineering Physics	73		85	30		194
Food, Ag. & Biological	73		92	26		197
Geomatics	79		95	22		196
Indust & Systems	80		103	16		199
Materials Sci	73		101	15		195
Mechanical	73		101	15		195
Metallurgical	73		101	15		195
Welding	73		96	21		196

*Note: Entry “Total” column is minimum requirement, NOT the sum of other columns.

3 Analysis

Several data gathering and analysis procedures were used to provide input for the revision of the Engineering GEC. Published reports including the report of the UCRC, data from benchmark institutions, outcomes assessment including senior exit and alumni surveys, and an evaluation of courses selected by students were among these sources.

3.1 Review of Published Documents

Information from two published reports were reviewed and used as input for the redesign of the Engineering GEC is summarized in the following two sections.

3.1.1 The Final Report of the Undergraduate Curriculum Committee

The Core Committee carefully reviewed in some depth the "The Final Report of the Undergraduate Curriculum Committee, June 2002" (UCRC report) with particular focus on *Section IV, Curricular Recommendations*. The committee generally concurred with the foundational statement of *Subsection A. Goals of a University Education at OSU*. To better understand the current and proposed changes to the GEC model and how current curriculum elements contribute to the goals of the model for engineering students, the committee mapped their perceptions of how the elements of the GEC requirements, the engineering core requirements, and the major-specific requirements contribute to the goals of General Education as defined by the UCRC report.

From "The Final Report of the Undergraduate Curriculum Committee, June 2002"

The Goals of a General Education

1. write and speak with clarity and precision so as to advance thoughts and arguments cogently and persuasively
2. read and listen critically with comprehension and intellectual curiosity
3. engage in critical analysis and logical thinking
4. understand the processes used in modes of inquiry across varying disciplines
5. understand, evaluate, and present quantitative data and symbolic terms
6. know about the forces that regulate the human life cycle and shape our environments, and understand the interactions among science, technology, the individual, and society
7. know and appreciate the diverse forms of the creative expression of human experience as articulated in literature and the visual and performing arts
8. comprehend the forces that have influenced the shaping of society and thus understand the foundations of the contemporary world in terms of both individuals and groups
9. acquire an understanding of American institutions and the pluralistic nature of American society and develop an appreciation for the range of cultural traditions that have formed and informed our nation
10. achieve an understanding of and develop an appreciation for the cultural diversity and global interdependence of the modern world
11. appreciate and understand other cultures and modes of thinking through facility with languages other than English

GEC Requirements

A. Writing and Related Skills

B. Quantitative and Logical Skills

continued on next page

C. Natural Science
D. Social Science
   i. Individuals and Groups
   ii.. Organization and Polities
   iii. Human, Natural and Economic Resources
E. Arts and Humanities
   i.. Historical Survey
   ii. Analysis of Texts and Works of Art
F. Diversity Experience
G. Foreign Language
H. Issues of the Contemporary World

Engineering Core Curriculum

Central Core: Introduction to Engineering I and II (6); Physics 131,132 (10); Chemistry 121 (5); Math 151,152,153,254 (20)

Selected Core: Nine topics intended to provide breadth for all engineering students from within the following three subsections; Additional Science, Mathematics and Statistics, General Engineering

The following points summarize the committee's observations of the Goals of the GEC relative to the curriculum elements (The instrument used and a summary of results is included as Appendix 4.):

- All three elements of the undergraduate engineering curriculum--GEC requirements, Engineering Core (Central and Selected) requirements, major-specific requirements--contribute in significant ways to the general/liberal education of the student. The requirements are seen as overlapping and complementary, as described in the Figure 2.1.
- For some goals, the principle components of the curriculum that contributed to the goals were narrowly focused in one curriculum element. Others were more broadly distributed. These contribution patterns will need to be carefully considered in any implementation plan. The goals noted below, which are supported by only one curriculum element, may need special attention and monitoring.
    (a) Goal 1 – "Write and speak with clarity and precision…" Only Category A. Writing and Related Skills is the principle contributor to this goal. The engineering core and major-specific courses combined are also strong contributors. Given the focus on communications in the First-Year Engineering courses (ENGINEER 181, 183, H191, H192, H193) and that the third writing course is in the major, this seemed consistent with expectations.
    (b) Goal 7 - "Know and appreciate the diverse forms of creative expression…" Category E. ii. Arts and Humanities – Analysis of Texts and Works of Art is the only strong contributor.
    (c) Goal 11 - "..facilities with language other than English." Category G, foreign language is the only strong contributor.
- The Engineering Core and major-specific courses were considered to be significant contributors to Goals 1 through 6, but not to Goals 7 though 11.

- No clear single principle curriculum element contributes to Goal 6 - "Know about the forces that regulate the human life cycle and …" This situation may need further study to clarify.

3.1.2 The ASEE White Paper on Liberal Education

A recent American Society of Engineering Education (ASEE) white paper (Steneck, et al., 2002) represents a consensus document developed by the Liberal Education Division of ASEE to assist guiding the general/liberal education for engineers. The paper "describes basic learning objectives that are broadly applicable to any engineering/technology program and that can reasonably be assessed in accordance with the ABET guidelines for program evaluation". The discussion is organized according to four broad categories. The Core Committee mapped the four categories and the associated subcategories defined by the paper against the eleven GEC Goals.

From, Steneck, et al, 2002.

ASEE Four Broad Categories for Liberal Education of Engineers:

1. Communication
   - 1.1. Critical thinking skills
   - 1.2. Communication strategies
   - 1.3. Fundamental writing and presentation skills
   - 1.4. Fundamental speaking and presentation skills
2. Professional Responsibility
   - 2.1. Professional organization
   - 2.2. Professional codes of conduct
   - 2.3. Professional regulation
   - 2.4. Ethical reasoning
   - 2.5. Personal values
3. Technology and Culture
   - 3.1. History of science and technology
   - 3.2. An introduction to STS (science, technology, and society) studies
   - 3.3. Contemporary issues
   - 3.4. Social ideals and values
4. Intellectual and Cultural Perspectives
   - 4.1. Fundamental assumptions about the nature of *reality* and *being*
   - 4.2. Ways of knowing
   - 4.3. Politics, society, and cultures

The following points summarize the committee's observations of the Goals of the GEC relative to the ASEE categories (The instrument used and summary of results are included as Appendix 5.):

- Comparison of the GEC Goals to the ASEE Liberal Education categories, showed that nine of the GEC Goals had one or more direct equivalents in the ASEE list. The two GEC goals which did not appear to have equivalents were:
  (a) GEC Goal 7 - "Know and appreciate the diverse forms of … visual and performing arts" and
  (b) GEC Goal 11 - "…facility with languages other than English".

- Comparison of the ASEE Liberal Education categories to the GEC Goals highlights that the entire category of "Professional Responsibility" in the ASEE Goals is not apparent in the GEC Goals.

3.1.3 Observations Based On The Two Documents

Based on the combination of the two comparison exercises, the Committee made the following general observations:

- The first element of this exercise helped to understand the match between the full engineering curriculum and the eleven goals of general education as listed in the Final Report of the Undergraduate Curriculum Review Committee (UCRC, 2002). Engineering Core and major-specific courses were noted to contribute significantly to Goals 1 through 6, but to a lesser degree to Goals 7 through 11. This review can be used as the Committee further assesses options and trade-offs within the GEC curriculum structure.
- The second element of the exercise pointed out the incongruence between the OSU Goals for General Education and the ASEE categories for Liberal Education. Goals for professional responsibility do not appear to be visible in the GEC Goals but are a significant element of the ASEE categories. Conversely, Goal 7 - "…visual and performing arts" and Goal 11 - "…language other than English" are in the GEC model but not the ASEE model.
- This exercise did not indicate priority across goals of the GEC. Nor did it indicate if a curriculum element was adequate to address the goal. These issues will need to be addressed in other ways.

The chair of the committee summarized the statement of observations regarding review of the UCRC Report and comparison to the ASEE white paper in a memo to the UCRC committee (Appendix 6).

3.2 Review of Benchmark Institutions

The Liberal Arts (LA) element of the curriculum of twelve (12) other institutions with engineering programs, that are part of the Big10+ Engineering Deans Organization, were researched. For this purpose, Liberal Arts (LA) courses were defined as those taken in general education, excluding those in math, physical, and biological sciences. Comparison of these institutions in terms of the elements of the OSU GEC model is presented in Table 3.1. All semester credits were converted to equivalent quarter credits. Footnotes are used for explanations that could not be included easily in the table.

Although general education and liberal education tend to be consistent across programs within an individual institution, total credits to the degree can vary by program. Therefore a comparison of the curriculum hours and percent of curriculum in Liberal Arts courses in shown in Table 3.2 based on three of the larger engineering programs, viz., Mechanical, Electrical, and Civil.

General observations for Tables 3.1 and 3.2 include:

- The OSU model has more subcategories than most other models.
- The use of courses to meet multiple requirements (similar to our diversity requirement) is a common practice.
- Although not a required element at any of the engineering programs, various ways to encourage the use of foreign language as part of a general education in engineering exist, generally as an alternative to a basic requirement. (See Table 3.1 Notes 3.1, 5.2, 6.1, 9.1, 11.2, and13.1.)
- 4) The OSU model is above the mean for benchmark institutions in both number of credits required in Liberal Arts courses (38 credits vs 32.2 credits) and percent of the curriculum in the category (19% vs. 17%).

Table 3.1 Liberal Arts–General Education Curriculum (LA–GEC) Comparison based on OSU's Engineering Model

(LA-GEC excludes all Math and Science GEC courses, all hours shown are in quarter hours. Quarter hrs = Semester hrs x 3/2)

University	English & Communication Skills			Foreign Language	Social Diversity in the United States	Social Sciences			Historical Survey	Arts & Humanities		Other	Total
	First Course	Second Course	Third Course			Ind & Grps	Org & Pol	Hum , Nat , & Econ Res		Literature	Visual/Performing Arts		
1. Ohio State	1 course = 5 hrs	1 course = 5 hrs	In major	Not required	Included in other courses	2 courses = 9 hours total from two of the gps			2 courses = 10 hrs	1 course = 5 hrs	1 course = 4 hrs		38
2. UT Austin	1 course = 4.5 hrs	In major	In major	Not required	Included in other courses	3 courses = 13.5 hrs Note 2.1			2 courses = 9 hrs	1 course = 4.5 hrs	1 course = 4.5 hrs		36
3. Univ of Iowa	6 hrs of rhetoric			Not required but can be used to substitute See Note 3.1	Included in other courses	4.5 hrs of lower level of Social Sciences 4.5 hrs of lower level Social Sciences <u>or</u> Humanities 9 hrs of upper level Social Sciences <u>or</u> Humanities			Not separate category	4.5 hrs of lower level Humanities 4.5 hrs of lower level Humanities <u>or</u> Social Sciences 9 hrs of upper level Humanities <u>or</u> Social Sciences			28.5
4. Purdue	A variety of combinations see Note 4.1												27
5. Penn State See Note 5.1	1 course = 4.5	1 course = 4.5	1 course = 4.5	Not required but can be used to substitute See Note 5.2	Included in other courses	2 courses = 9 hrs in Social & Behavorial Sciences See Note 5.3			Not separate category	2 courses = 9 hrs in Arts 2 courses = 9 hrs in Humanities		1 course = 4.5 hrs in Health & Physical Activity	45 See note 5.4
6. Univ of Michigan	If a "C" or better is earned in the Intro to Eng course req. is met (6 hrs)	In major	Not required	Not required but can be used to substitute See Note 6.1	Included in other courses	24 hrs 2 courses = 9 hrs in humanities 2 courses = 9 hrs of a sequence in humanities or social science (history is included in hum & soc sci) 6 hrs taken in either humanities or social science							24

7. Univ of CA at Berkeley see note 7.1	1 course = 4.5 hrs	Not required	Not required	Not required	Included in other courses	Not required	1 course = 4.5 hr	1 course = 4.5 hr	Not required	2 upper division courses must be taken from any approved category = 9 hrs, 1 additional course from any category = 4.5 hrs	27
8. GA Tech	1 course = 4.5 hrs	1 course = 4.5 hrs	Not required	Not required	Included in other courses	4 courses = 18 hrs		2 courses = 9 hrs		Not required	36
9. Univ of Illinois	1 course = 6 hrs	Can be taken in many of the Soc Sci and Hum courses	Not required	Not required but can be used to substitute See Note 9.1	Included in other courses	2 courses = 9 hrs	Not separate category	2 courses = 9 hrs		2 courses = 9 hrs from a large list	33
10. Univ of Minnesota	1 course = 6hrs	In major		Not required	Included in other courses	2 courses = 9 hrs	1 course 4.5 hrs	2 courses 9 hrs			28.5
11. Univ of Wisconsin	Note 11.1		Not required	Not required but can be used to substitute See Note 11.2	Note 11.3						24
12. Carnegie Mellon	1 course = 4.5 hrs	Not required		Not required	1 course = 4.5 hrs in Humanistic Studies, 1 course = 4.5 hrs in Cognition and Institutions, 3 courses = 13.5 hrs as a sequence in humanities, social science or fine arts which provide depth in a specific area.					2 courses = 9 hrs of unrestricted humanities, social sciences or fine arts	36
13. Case Western	1 course = 4.5 hrs	Professional Communication for Engineers = 4.5 hrs		Not required but can be used to substitute See Note 13.1	An approved sequence of 3 courses = 13.5 hrs in a single department or program in the humanities or social sciences. A minimum of 2 courses = 9 hrs in the humanities or social sciences. One course = 4.5 hrs in the humanities or social sciences.						36

NOTES:

1. OSU
2. UT Austin
   2.1. Social Science includes 9 hours of American & Texas Government and 4.5 hours of a Social Science course.
3. Univ. Iowa
   3.1. Two options. Foreign Language Incentive Program (FLIP) Option 1 – Entering students who complete an approved course at a level beyond the final course in a General Education approved foreign language sequence with a grade of B- or higher will receive 4 SH of credit. Option 2 – Students who completed four years of second language study in high school, or who have completed the Foreign Language component of the General Education Program by some other means, including foreign language study at The University of Iowa, may, at any time prior to graduation, earn up to 4 SH of addition credit for study of a language different from that which they applied to the General Education Program. Students may receive an additional 2 SH for the second, sequential course in that language that they complete with a grade of B- or better. Credit through FLIP Option 2 may be earned in two different languages, for 4 SH in each, for a maximum of 8 SH overall.
4. Purdue
   4.1. At least 9 SH of courses with global/societal content. At least 6 SH must be taken and no more than 12 SH may be taken in one department. At least 6 SH hrs of non-introductory courses must be taken. If a foreign language is taken, at least 6 SH are required in the same language. Credit is not allowed for language courses in the student's native tongue(s), but literature, culture, drama and related courses are allowed. Credit by examination or granted credit may be used to satisfy any part of the requirement. No course may be used more than once, even if the offering department allows it.
5. Penn State
   5.1. 3 SH of Intercultural & International study are required but this requirement can be simultaneously taken with a Social Science, Arts, or Humanities course.
   5.2. A language course at the 12^{th} credit level or higher can be substituted for 3 SH of Arts, Humanities, or Social Science requirements.
   5.3. Economics courses required in all engineering majors except Computer Science, can double count as a Social and Behavior requirement.
   5.4. The number of hours may be reduced by a number of different means as maximum flexibility is given in how the requirements are met. The College of Engineering at Penn State has the authority to allow a wide range of substitutions and experimentation.
6. Univ Michigan
   6.1. Language credit of up to eight semester hours may be earned by examination or by completing qualifying courses at the Univ of Michigan. If the language credit earned is at the first-year level, then the credit hours may be used only as unrestricted

electives. If the language credit earned is at the second-year level, then the credit hours may be used as humanities or unrestricted elective credits.

7. Univ of CA Berkeley
   7.1. While the official requirements state that 3 SH (4.5 qtr hrs) are required for each course, in reality most of the courses that are offered are 4 SH (6 qrt hrs). Consequently, most students have to take more than 27 qtr hours to complete their liberal arts requirements. The range of hours for the liberal arts requirements is 27 – 31.5 qtr hrs.
8. GA Tech
9. Univ of Illinois
   9.1. Three years of a single high school language will meet this requirement. Foreign language may be counted as College Humanities, but not Campus Hum&Arts.
10. Univ of Minnesota
11. Univ of Wisconsin
    11.1. The Univ of Wisconsin has an Engineering Professional Development Department in the College of Engineering. This department offers a large number of courses and students can earn a Technical Communication Certificate from them along with a Master of Engineering in Professional Practice and a Master of Engineering in Technical Japanese. Two of the courses they teach EPD 155 & 397 allow engineering students to meet the university's writing general education requirement.
    11.2. Students taking language courses are considered to have met the breadth requirement of the general education requirement. While this does not decrease the number of liberal arts courses the student must take it does allow them to take lower level ones rather than higher level ones.
    11.3. A complicated mixture of courses is required but a minimum of 16 SH must be taken. Some of the courses are specified by the discipline while categories have many more choices and by wise choices a student can fulfill a number of requirements with one course. The key element is depth and breath.
12. Carnegie Mellon
13. Case Western
    13.1. Two semesters of beginning work in a foreign language may be counted toward satisfaction of the requirement for a three course sequence only when the sequence consists of three courses taken in a single foreign language. Credit for the first semester of beginning study (101 level) in a foreign language will not serve toward satisfaction of any degree requirement unless credit is earned for the second semester (level 102) as well.

Table 3.2 Comparison of the Percent of LA-GEC Quarter Hours Required

University	LA-GEC hours, from Table I	Total hours for degree				% LA-GEC hours based on mean total
		Mechanical	Civil	Electrical	Mean	
Univ Michigan	24	192	192	192	192	12%
Univ of Wisconsin	24	180	189	186	185	13%
Purdue	27	195	199	186	193.3	14%
Univ Iowa	28.5	192	192	192	192	15%
Univ of Minnesota	28.5	190.5	193.5	189	191	15%
Univ of CA Berkeley	27	180	180	180	180	15%
Univ of Illinois	33	198	199.5	192	196.5	17%
GA Tech	36	189	192	198	193	19%
Case Western	36	193.5	193.5	192	193	19%
Ohio State	**38**	**195**	**200**	**199**	**198**	**19%**
UT Austin	36	189	186	184.5	186.5	19%
Carnegie Mellon	36	190.5	186	180	185.5	19%
Penn State	45	205	201	193.5	199.8	23%
Averages	32.2	191.5	192.6	189.5	191.2	17%

3.3 Summary of Outcomes Assessment Data

Since 1998-1999, the College of Engineering, through its Outcomes Assessment Committee (OAC), has been actively engaged in a systematic evaluation of the results of its programs. This includes a system of surveys of exiting seniors, 2nd-, 6th- and 15th-year alumni. The OAC has also conducted targeted surveys to further explore selected issues. To date these issues have been: (1) business and finance, (2) lifelong learning, (3) ethics and professional behavior, and (4) liberal education. Inputs from these surveys are being used to guide curriculum revisions, such as this reconsideration of GEC requirements for engineering.

A summary report of data is developed each year by the college and shared broadly within the college. Table 3.3 is a summary from over 2,100 respondents (Years 1998-2002) for twenty-six items included in the Educational Outcomes segment of the survey. The OAC has found it important in the interpretation of results to look carefully at both the relative importance of an item as well as the difference between Importance and Ability/Preparation which they defined as the Gap in performance.

Table 3.3 Educational Outcomes Summary Across All Alumni, All Programs, and All Years.

Scales:

Importance: Not Important = 1, Somewhat Important = 2, Important = 3, Very Important = 4, Extremely Important = 5;

Ability on the Job or Preparation: Not prepared = 1, Somewhat Prepared = 2, Prepared = 3, Well Prepared = 4, Very Well Prepared = 5; and

Gap: Ability/Preparation minus Importance

	Importance	Ability/Prep	Gap
An understanding of and ability to apply knowledge of:			
Mathematics	3.27	3.83	0.56
Chemistry	2.32	3.00	0.68
Physics	3.31	3.54	0.23
Engineering Science	3.60	3.58	-0.02
Comp Science	3.78	3.28	-0.50
Humanities/Social Science	2.48	3.01	0.53
Business/Finance	3.35	2.61	-0.75
An understanding of and ability to:			
Conduct Experiments	3.54	3.33	-0.20
Analyze Data	3.92	3.55	-0.36
Design a System	4.10	3.43	-0.67
Multi-Disciplinary Teams	4.24	3.45	-0.79
Solve Problems	4.23	3.74	-0.49
Ethical Responsibility	3.96	3.31	-0.65
Communicate Orally	4.30	3.26	-1.04

Communicate in Writing	4.26	3.44	-0.82
Stay Current	3.93	3.27	-0.66
Use Skills in Practice	3.92	3.47	-0.45
An understanding of and ability to:			
Function in Diverse Environments	3.51	3.43	-0.08
Use Computing Technology in Communication	4.03	3.56	-0.48
Use Computing Technology in Analysis/Design	4.02	3.43	-0.59
Integrate Knowledge	3.70	3.16	-0.54
Use Wide Range of Apparatus	2.95	2.87	-0.08
An understanding of:			
Environmental aspects	3.04	2.65	-0.38
Engineering on a Global Scale	2.91	2.50	-0.42
Relation of Engineering to Society	2.67	2.49	-0.19
Being a Licensed Professional Engineer/Surveyor	2.39	2.62	0.23

Information gained from the first four years has been summarized and shared with engineering colleagues by Gustafson and McCaul (2003). This paper points out that both Importance and Ability/Preparation responses tend to decrease slightly with years since graduation, however the gap does not appear to have a trend, remaining relatively constant. In aggregate, it does not appear that variation with years since graduation is significant. A common posed hypothesis is that alumni only see increased value of some topics, such as those related to social sciences and humanities, some years after graduation. As demonstrated in Figure 3.1, this hypothesis is not supported by these data.

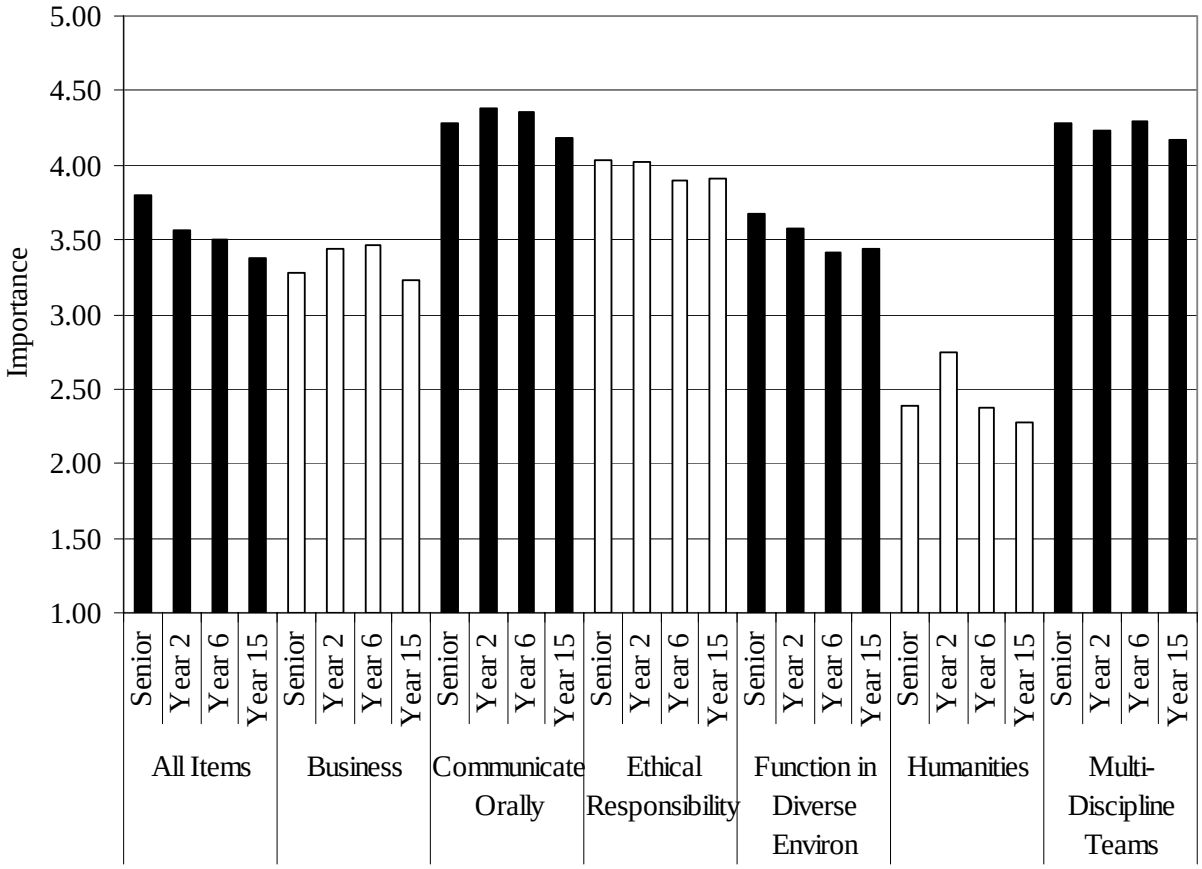

Figure 3.1 Importance of Selected Topics by Alumni Years

The College of Engineering is being responsive to the outcomes assessment data. Continuous quality improvement efforts are ongoing. Priority has been given to items that are high in Importance and where a Gap (negative or positive) has been identified. Example changes include:

(1) in the recently approved Engineering Core,
chemistry – the requirement has been adjusted to allow more flexibility in the science base required and the Department of Chemistry has worked with the college to revise the content of Chemistry 125.
physics – the third physics course is not now required in the engineering core or by all programs
math – provided flexibility in the course taken in advanced math topics to better fit the individual programs.
(2) *business and finance* - engineering students are being encouraged to use the business minor and additional project management has been added in the core courses and major courses.
(3) in the common first-year engineering courses
oral and written communication – structured training and practice have been increased
(4) *teamwork* - training and experience in teamwork has been dramatically increased.

(5) a committee of the college has been exploring opportunities to improve the *capstone design* experience.

3.4 Summary of Alumni Liberal Education Survey

A special survey, sent with the regular alumni survey for 2002-2003, was done to study the nature of the difference between perceived importance verse preparation of College of Engineering B.S. graduates in the area of liberal education for engineers. The goal of the study was to give guidance to our programs in the evaluation of engineering's liberal arts requirements. This is one of the "gaps" between Ability/Preparation and Importance identified in previous alumni surveys. It is most closely related to ABET EC 2003 Criterion 3. (h) "the broad education necessary to understand the impact of engineering solutions in a global and societal context" and Criterion 3 (j) "a knowledge of contemporary issues". The survey was designed to address two main issues of:

1) importance alumni place on various liberal education topics, and
2) improved ways of addressing liberal education in the engineering curriculum.

The elements of the survey were:

1. Asking respondents to indicate how they would rate *importance* of ten liberal education topics in preparing engineering graduates. [1) Writing and Communication Skills, 2) Visual and Performing Arts, 3) Literature, 4) Issues of the Contemporary World, 5) International Issues, 6) History, 7) Foreign Language, 8) Ethics and Professionalism, 9) Diversity in the United States, and 10) Diversity (non-western cultures)]
2. Asking respondents to indicate how they would distribute a limited number of courses across liberal education topics.
3. An open-ended question asking 'what liberal education courses did you find to be of most value to you'.
4. An open-ended question asking 'what liberal education courses did you find to be of least value to you'.
5. An open-ended question asking 'what changes would you recommend to our liberal education curriculum'.

After being reviewed by the Outcomes Assessment Committee the survey was included as an extra page with the 2002-2003 alumni surveys. Surveys were mailed to engineering alumni of the 2nd (2000), 6th (1996), and 15th (1987) year alumni groups based on addresses maintained by the Ohio State University Alumni Association. For the general survey 377 useable surveys were returned, while for the special survey segment 373 useable surveys returned. This rate of return was high when compared to previous special surveys.

A full report can be found at http:/www.osu.edu……..) Results of the first question are summarized in Table 3.4 with topics ordered by decreasing importance rating.

Table 3.4 Importance Rating of Liberal Education Topics by Alumni

Topic	Not Important (1)	Somewhat Important (2)	Important (3)	Very Important (4)	Extremely Important (5)	Mean
Writing & Com	0.0%	0.5%	4.8%	31.1%	62.2%	4.6
Ethics & Prof	1.1%	5.1%	20.4%	35.4%	36.7%	4.1
Intl Issues	7.2%	24.4%	38.1%	21.4%	7.5%	3.0
Diversity US	13.1%	21.4%	33.5%	19.0%	11.0%	3.0
Contemp Wld	8.0%	23.9%	38.1%	24.4%	4.3%	3.0
Diversity non W	14.8%	27.1%	32.2%	14.8%	9.4%	2.8
History	9.6%	40.8%	32.7%	12.9%	2.4%	2.6
Foreign Lang	26.3%	29.2%	23.6%	15.0%	4.0%	2.5
Literature	23.1%	40.5%	24.7%	9.1%	0.5%	2.3
V/P Art	36.7%	41.3%	13.9%	5.4%	0.5%	2.0
Note: A small number of people responded with non-integer numbers. Their responses are not included in the count but are included in the mean.						
					Mean of means	3.0

Distribution and a mean for number of the eight courses assigned to each category are summarized in Table 3.5. A small number of persons responded with non-integer numbers. Their responses are not included in the count but are included in the mean.

Table 3.5 Suggested Course Distribution for Liberal Education Topics

	Number of Courses									
Topic	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Mean**
Writing & Com	1	29	166	96	44	7	5	0	0	2.6
Ethics & Prof	33	216	90	3	3	0	0	0	0	1.2
History	133	163	46	3	0	0	0	0	0	0.8
Contemp Wld	124	200	10	0	0	0	0	0	0	0.6
Intl Issues	131	196	9	0	0	0	0	0	0	0.6
Foreign Lang	223	70	42	9	2	0	0	0	0	0.6
Diversity US	176	156	7	0	0	0	0	0	0	0.5
Literature	194	142	8	0	0	0	0	0	0	0.5
Diversity non W	234	103	2	0	0	0	0	0	0	0.3
V/P Art	267	71	6	1	0	0	0	0	0	0.2

The second element of the survey asked three open-ended questions. The questions and a very brief summary are:

Question 1: Based on your experiences, what liberal education courses have you found to be of most value to you?

The most common response here was communications to include written (many specified technical writing), oral, and presentation skills.

Question 2: Based on your experiences, what liberal education courses, have you found to be of least value to you?

The most common response here was visual & performing arts/theater. The second most common response was literature.

Both Question 1 & 2 had a number of other responses such as history, foreign language, geography, sociology, philosophy, psychology and others but there was the about the same number of positive as negative comments for these categories.

Question 3: What changes would you recommend be made to our liberal education curriculum?

The most common response was to add more classes that would better prepare graduates to be able to communicate in a variety of mediums. The second and third most common responses were to add an Ethics class and to have more Business classes. Other suggestions included reduce the number required, add language, better guidance, make courses more relevant to engineering, and make more flexible.

Based on a focused survey on liberal education for engineers, four main observations can be made. All four are consistent across year group, gender, and ethnicity. Our graduates report that:

- the courses they take for their liberal education requirement can best serve them by giving them the ability to effectively communicate both in writing and orally. The ability to communicate effectively was by far the highest rated and most mentioned subject.
- they need a solid foundation in ethics and professionalism. Ethics and professionalism was the second highest rated subject as well as the fourth highest recipient of comments on what should be changed in the liberal education portion of our curriculum.
- courses need to be more applicable to their chosen profession of engineering. Many of the individuals who rated certain subjects low commented that they did so as it was not made applicable their perceived needs.
- emphasis needs to be given to an international or global perspective. For example, many of our graduates feel that learning about global diversity/world affairs was as important than learning about diversity within the United States.

3.5 Summary of Current Student Course Selection

To establish the pattern of courses being taken by students for the General Education element of the current Engineering GEC model, transcripts of 170 students graduating from the College of Engineering in 2002 were audited. Table 3.6 summarizes the most popular courses within each of the categories. A complete listing of courses and frequency of enrollment is included in Appendix 7.

Table 3.6. Most Popular Courses for General Education Requirements
(n = 170 students)

Subject	All Students	Regular	Honors
2nd Writing			
English	53.3%	54.5%	50.9%
Comparative Studies	8.9%	11.6%	3.5%
Social Diversity			
English	37.6%	33.1%	49.0%
Sociology	37.1%	38.8%	32.7%
Comparative Studies	7.6%	9.9%	2.0%
Social Sciences			
Ind. and Groups			
Psychology	53.2%	53.6%	52.0%
Organizations and Polities			
Sociology	42.8%	43.2%	41.6%
Human, Natural and Econ Resources			
Economics 200	59.2%	50.4%	45.8%
Historical Survey			
History 151/152	64.3%	65.9%	60.4%
History 111/112	26.3%	27.6%	22.9%
Literature			
Classics	33.7%	35.0%	30.6%
English	26.7%	27.6%	24.5%
Ethnic Literatures	15.7%	14.6%	18.4%
Comparative Studies	12.8%	9.8%	20.4%
Philosophy	5.2%	5.7%	4.1%
Visual/Performing Arts			
Philosophy	26.5%	27.9%	22.9%
Theater	17.1%	15.6%	20.8%
Art/Art Education	10.6%	10.7%	10.4%
Music	6.5%	4.9%	10.4%
Linguistics	5.9%	5.7%	6.3%

These data show how current students are making selections within the present Engineering GEC model. It may also be helpful in estimating the enrollment impact of any proposed curriculum shifts.

3.6 Opportunities for Improvement

Based on the analysis and inputs available, the Core Curriculum Committee identified areas for further study. These were a combination of areas where the Committee felt there were opportunities for improvement in our current GEC model. The four general areas were: (1) ethics and professional responsibility; (2) social sciences, historical survey, and arts & humanities; (3) foreign language; and 4) capstone design, pre-capstone

design, and technical writing. Subcommittees of the main committee met and explored these issues. Their findings and recommendations are embedded in the suggested changes for the Engineering GEC model reported in the next section.

4 Recommendations for the Engineering GEC and a Proposed Model

As noted earlier, there is general concurrence between the goals established by the university for an educated person and for general education. As reflected in the current Engineering GEC model, engineering may place a different level of focus on various elements compared to other curricula. As pointed out by the American Association of Colleges and Universities 2002 Report Greater Expectations – A new Vision for Learning as a Nation Goes to College,

> "Liberal education is an educational philosophy rather than a body of knowledge. By drawing on a broad range of knowledge, it asks students to grapple with complicated important issues, and usually expects them to learn at least one subject in greater depth and at an advanced level. Intellectual growth occurs as both broad and deep learning challenge previously held beliefs. The philosophy of liberal education depends less on particular subject matter than on an approach to teaching and learning. A student can prepare for a profession in a "liberal" mind-expanding manner, or study the humanities or social sciences (traditional "liberal arts" disciplines) narrowly and shallowly."

Given the significant competition for curriculum space in engineering programs, it is imperative that all elements of the curriculum work together in a coordinated fashion towards the goals. This would imply careful selection of the elements of the curriculum and additional focus on the overlapping domains.

4.1 Recommendations

Recommendation 1 – Review of 3rd Writing Course in the Major

All outcomes assessment reinforced the importance of written and oral communication. Although recent changes in the engineering core courses have been directed towards this issue, it is the opinion of the committee that it needs to explore further the effectiveness of our English and Communication Skills component. In particular, since it has not received direct review by the college since its inception, the third writing course in the major should be studied.

Recommendation: The Core Curriculum and College Services Committee, in collaboration with the College of Engineering Technical Communications Center and University Writing Center, review the 3rd Writing Requirement for Engineering. Anticipated outcomes would be the enhancement of the courses, not a basic change in structure or courses required.

Recommendation 2 – Encourage Foreign Language Courses through Substitution

In an increasingly internationalized professional practice environment, the college would like to encourage facility in languages other than English for its students. Our own analysis of values shows language contributing most to GEC Goals 7, 8, and 10 as well as 11 (See section 3.1 and Appendix 4). Given the content of the language courses, it would appear reasonable to allow students to substitute more advanced courses in language for either elements in Social Science or Arts and Humanities. The committee also feels that it is appropriate to encourage additional depth by encouraging completion of a foreign language minor. International studies should be facilitated by in-depth study through the minor. This approach is consistent with patterns used by benchmark institutions as reported in Section 3.2.

Recommendation:
(a) The completion of a single foreign language sequence through the 104 level (one to four language courses) can be substituted for one (5 hour) GEC course requirement within the Arts & Humanities category. A student receiving advanced placement through the 104 level must take a minimum of one foreign language course beyond the 104 level to receive this GEC credit. These must be in a language regularly offered at OSU and non-native to the student.
(b) The completion of a minor within a foreign language department (which includes the completion of a language through 104) can be substituted for two (5 hours each) GEC courses; one from Arts & Humanities, the second from either Arts & Humanities or Social Sciences. This two-course substitution is NOT in addition to Part (a).

Recommendation 3 – Increase Category of Social Sciences by One Credit

In establishing the engineering GEC in 1987, the requirement for the Social Science category was set at 9 credits. Since courses other than five credits are not readily available or widely used, this establishes a hidden requirement of one credit. The proposed change brings the credit requirement in line with the five-credit modules available in the categories.

Recommendation: Increase the required credits in Social Sciences category by one credit to 10 credits.

Recommendation 4 – Decrease Arts & Humanities, including History, Requirement to Ten Credits

In establishing the engineering GEC in 1987, the requirement for the Visual/Performing Arts or other Arts and Humanities category was set at 4 credits. Since courses other than five credits are not readily available or widely used, this establishes a hidden requirement of one credit. The proposed change brings the credit requirement in line with the five-credit modules available in the categories.

Previous descriptions of the Engineering GEC had shown Historic Survey as a category separate from other Arts & Humanities. At this time, Historic Survey is included as a subcategory of Arts and Humanities to be more consistent with the GEC model of the Colleges of the Arts and Sciences.

After its analysis of goals of the GEC and contribution of each category, and consideration of balance of experience in the curriculum for the student, it is the opinion of the committee that the goals of the GEC will still be attained with:

(a) the reduction to one course in history. In comparison with benchmark schools (12), it appears that only one other institution specifically requires two courses in history (UT Austin), two others have a one course history requirement, and that others do not have history in a separate category,

(b) requiring one course in Analysis of Texts and Works of Arts. This grouping is a combined the categories of Literature and Visuals and Performing Arts and Other Humanities of the previous Engineering GEC model under a title consistent with the current College of Arts and Science GEC model, and

Recommendation: In the categories of Arts & Humanities, require a total of 10 credits. One course would be required from each of two subcategories; A. Analysis of Texts and Works of Art, and B. Historic Survey.

Recommendation 5 - Create an Ethics and Professionalism Curriculum Requirement

In its analysis of available outcomes assessment data, the UCRC Report and the current GEC model, the College of Engineering Core Committee came to the conclusion that the area of ethics and professional responsibility needs to be a more significant element in the Engineering GEC and the curriculum at large. A recent ASEE White Paper on Liberal Education (Steneck, et al. 2002) identifies elements that should be part of the liberal education of engineering students. These elements and curriculum goals were used as the basis for a discussion with Departments (e.g. Philosophy, Comparative Studies, History and English) regarding potential course offerings relevant to this area. A discussion document (Appendix 8.1) was used to identify strategies for meeting curricular goals in this area.

The committee concluded that Ethics and Professionalism should be addressed in the three elements of the curriculum: (1) the first-year engineering programs as part of the Engineering Core, (2) the Engineering GEC, and (3) as an element of a course or courses within the major.

Recommendations:
(a) Inclusion of the topic of engineering ethics should be continued as an element of the Introduction to Engineering courses (ENGINEER 181/183 and ENGINEER H191/H193).

(b) Creation of a new category of "Ethics and Professionalism" in the Engineering GEC. This category would overlap with and also be considered part of the Engineering Core. As with other categories of the engineering core, courses would be approved for the category by the Core Curriculum and Undergraduate Services Committee. The Core Committee would also be responsible for monitoring the courses listed over time to assure objectives of the category are being met. Proposed procedures criteria and procedures are included within Appendix 8.2 and 8.3. A tentative list of courses to be considered is shown below. Courses for this category will likely come predominantly from units in the Colleges of the Arts and Sciences, although courses from other units will be considered. Discussions with the offering Departments regarding needed capacity as well as content have been established.

ETHICS & PROFESSIONALISM (5 hrs) - Tentative List
Philosophy 130, 130.0X, 367, 533
Comparative Studies 272, 367.02, 535, 597.01

A course taken by students to meet this requirement will not be allowed to count in other categories (no double counting) except for meeting the diversity requirement. Letters from potential offering units are attached as Appendix 8.3.

(c) The Core Curriculum Committee, encourages continued work on assessing how the college and programs can better prepare students in the area of ethics and professional responsibility. This may be included in the concept of a college-wide pre-capstone design course. Some discussion in the college has occurred regarding the development of a common, college-wide capstone course that would focus on elements of the design process in a multidisciplinary environment with ethics and professional responsibility considered. Such a course would precede a discipline based capstone design course or course sequence. Given that such a course would take considerable development time and will not directly impact the Engineering GEC model, and that majors already address ethics and professionally responsibility to some extent in ways specific to the major, it is not being included in this proposal. It may be advanced at a later date.

<u>Recommendation 6 – Allow Substitution of Capstone (XXX 597) for GEC Lower Level Social Science Requirement</u>

Students should take higher-level GEC courses when possible. One method to facilitate this, to a limited degree, would be more utilization of the University approved capstone (597 courses) by engineering students. Engineering students could certainly contribute to these courses and benefit by their interdisciplinary nature.

Recommendation: Engineering students be allowed to take one 597 University Capstone course in the place of one course in the Social Science category. This course may NOT be also counted in another category, such as ethics and professionalism.

<u>Recommendation 7 – Expand Category of Natural Sciences to Natural Sciences and Technology</u>

The UCRC report acknowledges the incompatibility between the General Education Goal "..understand the interactions among science, technology, the universe, the individual, and society" and the dearth of coursework in the proposed GEC category (Natural Science) to address the matter of technology. The UCRC report also acknowledges that the committee discussed the issue at length and concurred with a report jointly issued by the National Academy of Engineering and the National Research Council (NRC) (Pearson and Young, 2002). The NRC Report (page 13) defines technology as:

> "In the broadest sense, technology is the process by which humans modify nature to meet their needs and wants. Most people, however, think of technology in terms of its artifacts: computers and software, aircraft, pesticides, water-treatment plants, birth-control pills, and microwave ovens, to name a few. But technology is more than these tangible products. The knowledge and processes used to create and to operate the artifacts – engineering know-how, manufacturing expertise, various technical skills, and so on – are equally important. An especially important area of knowledge is the engineering design process, of starting with a set of criteria and constraints and working toward a solution – a device, say, or a process – that meets those conditions."

The NRC Report (page 17) also identifies characteristics of a technologically literate citizen in three areas as:

1) Knowledge

- Recognizes the pervasiveness of technology in everyday life.
- Understands basic engineering concepts and terms, such as systems, constraints, and trade-offs. Is familiar with the nature and limitations of the engineering design process.
- Knows some of the ways technology shapes human history and people shape technology.
- Knows that all technologies entail risk, some that can be anticipated and some that cannot.
- Appreciates that the development and use of technology involve trade-offs and a balance of costs and benefits.
- Understands that technology reflects the values and culture of society.

2) Ways of Thinking and Acting

- Asks pertinent questions, of self and others, regarding the benefits and risks of technologies. Seeks information about new technologies.
- Participates, when appropriate, in decisions about the development and use of technology.

3) Capabilities

- Has a range of hands-on skills, such as using a computer for word processing and surfing the Internet and operating a variety of home and office appliances.
- Can identify and fix simple mechanical or technological problems at home or work.
- Can apply basic mathematical concepts related to probability, scale, and estimation to make informed judgments about technological risks and benefits.

In its revised final report (page 33), the UCRC viewed "that these are worthwhile goals that warrant the inclusion of technology (and not merely computer literacy) in the GEC." However the Committee did not make any specific recommendations as to how they might be integrated into the curriculum.

As also acknowledge by the NRC report (page 13), "science and technology are tightly coupled. A scientific understanding of the natural world is the basis for much of technological development today." Therefore, it would seem reasonable to link natural sciences and technology for purposes of the general education of our students.

The College of Engineering sees the inclusion of technology as important to the general education of all students, including engineers. Within its current engineering core curriculum, is a course required of all beginning engineering students (ENGINEER 181 – Introduction to Engineering I, see Appendix 9 for course syllabus) that addresses these issues in a significant way. As stated in the course objectives,

> "This course is designed to help students develop an understanding and appreciation of engineering, the problems solved and contributions made by engineers from various disciplines, and the engineering design process. Students will learn and practice fundamental skills useful to engineering students and professional engineers in many fields. In addition, students will develop their study skills and improve their understanding of material in their technical courses during the teamwork portion of the course."

Recommendation: For purposes of the Engineering GEC, (1) the category of Natural Science of the ASC GEC Model be re-titled Natural Science and Technology, and (2) ENGINEER 181 (3 credits) be added as a requirement of the category to enhance addressing the goals of technological literacy.

Since ENGINEER 181 is currently a requirement of all programs, this recommendation will not change the credits to the degree for any program.

<u>Recommendation 8 – Expand Category of Diversity Experience to include International Issues</u>

Currently engineering students are limited in the courses they can take in the category of Diversity Experience to those courses in the Social Diversity in the United States subcategory. Many of the degrees in Arts and Science require three courses in the category of Diversity Experience – one course from Social Diversity in the United States and two courses from International Issues (one from Non-Western or Global and one

from Western [non-United States]). Thus, a student in Arts and Science would take two courses in global diversity but only one course in U.S. diversity. Engineering's alumni surveys have consistently shown support for the idea of the internationalization of engineering and the need for engineers to have knowledge of other countries and peoples. Allowing engineering students to pick from any of the courses listed under Diversity Experience would allow them an opportunity to learn about global issues while completing their diversity requirement.

Recommendation:
(a) The completion any course from the approved list of courses in either subcategory under Diversity Experiences by an engineering student counts as completion of the diversity requirement.

4.2 The Proposed Model

Based on the above review of information and recommendations, the proposed model for the Engineering GEC was developed. Table 4.1 shows the proposed new requirements in the first column and, for sake of comparison, the existing requirements in the second column. There is a one course reduction across the combination of Categories of Social Sciences, Arts and Humanities with the addition of Ethics and Professionalism. Credits in the category of LA-GEC (see Table 3.2) would be reduced from 38 to 35 with a corresponding reduction in % LA-GEC from 19 % to 18 %. This would still leave the OSU Engineering GEC model above the mean of other comparable engineering curriculums for both course credits and % LA in the GEC. When approved, this proposal will result in a reduction of three credits to degree for all engineering students.

Table 4.1 Engineering GEC Models	
Proposed Model	**Current Model**
English & Communications Skills A. First Course – English 110 (5 hrs) B. Second Course (5 hrs) C. Third Course (major department)	English & Communications Skills A. First Course – English 110 (5 hrs) B. Second Course (5 hrs) C. Third Course (major department)
Foreign Language(waived, may substitute up to 2 courses, 104 level or above, for Arts and Humanities and Social Science. See Rec. 2 for details.)	Foreign Language (waived)
Diversity Experience (0 hrs)	Social Diversity in the U. S. (0 hrs)
Social Sciences (10 hrs - selected from two groups) A. Individual and Groups B. Organizations and Polities C. Human, Natural, and Economic Resources	Social Sciences (9 hrs - selected from two groups) A. Individual and Groups B. Organizations and Polities C. Human, Natural and Economic Resources
Arts and Humanities (10 hrs - one from each group) A. Analysis of Texts and Works of Art (Literature, Visual/Performing Arts & Culture and Ideas) B. Historical Survey	Arts and Humanities (9 hrs) A. Literature (5 hrs) B. Visual/Performing Arts and other Arts and Humanities (4 hrs)
	Historical Survey (10 hrs)
Ethics and Professionalism (5 hrs – selected from approved list)	
University Capstone (waived - may substitute for 5 hrs Social Science)	University Capstone (waived)
Quantitative Analysis (20 hrs) Math 151,152,153,254	Quantitative Analysis (20 hrs) Math 151,152,153,254
Natural Science and Technology (23 hrs) A. Chemistry 121 B. Physics 131,132 C. Additional Science (one course from approved list) D. Engineering 181	Natural Science (20 hrs) A. Chemistry 121 B. Physics 131,132 C. Additional Science (one course from approved list)
Total = 78 hrs	Total = 78 hrs

5 Outcomes Assessment Plan for General Education in Engineering

The College of Engineering has been fully engaged in outcomes assessment since 1998. Each program in the College has a system of annual outcomes assessment. As highlighted earlier, the College as a unit supports programs through an Outcomes Assessment Committee. This committee oversees the development of outcomes assessment approaches including annual surveys of exiting seniors, 2nd-, 6th-, and 15th-year alumni. Although the survey reported herein addresses issues of general education, the Outcomes Assessment Committee has agreed to review and revise its basic senior exit and alumni surveys to more specifically address the goals of the OSU model for general education. An anticipated outcome will be better benchmarking of our accomplishments relative to the general education goals.

6 Implementation Plan

Contingent on Council on Academic Affairs approval, implementation of this curriculum change is planned for Autumn Quarter, 2005.

A student advising sheet will be developed for each program, showing how this new Engineering GEC model would be implemented for each program. A draft general version of such a sheet is included as Appendix 10 for demonstration purposes.

The following guidelines will be followed during implementation:

1. The new Engineering GEC will be mandatory for all students entering OSU or transferring to engineering within the University for the Autumn Quarter, 2005 and after.
2. Students who entered OSU prior to Autumn Quarter 2005 have the right to finish the curriculum that they started under in their program with the following exceptions: students who are reinstated after being dismissed from the college or the university, and students who are returning after an absence of 5 years or more. The committee that reinstates the student will determine which curriculum the student will follow.
3. Students who entered OSU prior to Autumn Quarter 2005 may decide at any time to switch to the new curriculum in their program. Once the student has switched, a letter to that effect signed by the student will be maintained in the student's advising file and a notation of the fact will be entered on the students MARX comment screen (RCOM). A copy of the letter will be sent to the College Office of Academic Affairs (COAA) and placed in the student's permanent file. No student may switch to the old Engineering GEC.

   Academic and faculty advisors will clearly inform students switching to the new curriculum in their program if the change
   (a) will cause the student to lose countable credit hours,
   (b) will cause a delay in the student's graduation date,

(c) will cause an increase in the required credit hours to the student's graduation.

A student with any one of these conditions may still switch at his or her option, but the student's letter stating the desire to switch must include an acknowledgment by the student of the itemized list of lost credit hours, added credit hours, or quarters of delay.

The college will work with units outside of the college upon which this policy will have an impact to attempt to estimate the magnitude and timing of any shifts in enrollment patterns that may occur.

7 Referenced Documents

ABET, 2001. Criteria for Accrediting Engineering Programs (2002-2003). Engineering Accreditation Commission, Accreditation Board for Engineering and Technology, Baltimore, MD.

Gustafson, R. and E. McCaul. 2003. Four Years of Senior and Alumni Surveys – What Have We Learned. Proceeding of ASEE NC Regional Meeting, April 14, Columbus, OH

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Ramaley, J. (Panel Chair) 2002. Greater Expectations, A New Vision for Learning as a Nation Goes to College. National Panel Report. Assoc. of American Colleges and Universities, Washington, D.C.

Steneck, N. H., B. M. Olds, and K. A. Neely. 2002. Recommendations for Liberal Education in Engineering: A White Paper from the Liberal Education Division of the American Society of Engineering Education. Proceedings of the 2002 ASEE Annual Conference.

UCRC. 2002. Final Report of the Undergraduate Curriculum Review Committee, Ohio State University

Appendix 1 College of Engineering Core Curriculum and Undergraduate Services Committee Membership

Committee Members 2002-2003

Aerospace Engineering – Michael Foster
Aviation – Gerald Chubb
Biomedical Engineering – Derek Hansford
Chemical Engineering – David Tomasko
Civil & Environmental Engineering and Geodetic Science – Frank Croft
Computer and Information Science – Neelam Soundarajan
Electrical Engineering – George Valco (Chair)
Engineering Physics – Robert Scherrer
Food, Agricultural and Biological Engineering – Gonul Kaletunc
Industrial & Systems Engineering – Gary Maul
Welding Engineering – Dave Dickinson
Material Science and Engineering – Carroll Mobley
Mechanical Engineering – Dan Mendelsohn
Associate Dean Academic Affairs & Student Services – Robert Gustafson
Program Director Career Services – Nickie Drake
Undergraduate Student – Allison Holub
Undergraduate Student (alternate) – Vikram Shyam
Department/Program Advisor – Pam Hussen
College of the Arts & Sciences Liaisons – Kirk Freudenburg and John Roberts
Committee Secretary – Ed McCaul

Committee Members 2003-2004

Aerospace Engineering – Gerald Chubb
Aviation – Gerald Chubb
Biomedical Engineering – Derek Hansford
Chemical Engineering – David Tomasko (Chair)
Civil & Environmental Engineering and Geodetic Science – Frank Croft
Computer and Information Science – Neelam Soundarajan
Electrical Engineering – Ed Newman
Engineering Physics – Linn Van Woerkom
Food, Agricultural and Biological Engineering – Gonul Kaletunc
Industrial & Systems Engineering – Gary Maul
Welding Engineering – Dave Dickinson
Material Science and Engineering – Carroll Mobley
Mechanical Engineering – Dan Mendelsohn
Associate Dean Academic Affairs & Student Services – Robert Gustafson
Program Director Career Services – Nickie Drake
Undergraduate Student – Josephine Clark
Undergraduate Student (alternate) – Shawn Gelsinger
Department/Program Advisor – Pam Hussen
College of the Arts & Sciences Liaisons – John Roberts
Committee Secretary – Ed McCaul

Appendix 2 ABET Criteria for Accrediting Engineering Programs – General Criteria (2002-2003), (ABET, 2001)

I. GENERAL CRITERIA FOR BASIC LEVEL PROGRAMS
It is the responsibility of the institution seeking accreditation of an engineering program to demonstrate clearly that the program meets the following criteria

Criterion 1. Students

The quality and performance of the students and graduates are important considerations in the evaluation of an engineering program. The institution must evaluate, advise, and monitor students to determine its success in meeting programs objectives.

The institution must have and enforce policies for the acceptance of transfer students and for the validation of courses taken for credit elsewhere. The institution must also have and enforce procedures to assure that all students meet all program requirements.

Criterion 2. Program Educational Objectives

Each engineering program for which an institution seeks accreditation or reaccredidation must have in place:

(a) detailed published educational objectives that are consistent with the mission of the institution and these criteria
(b) a process based on the needs of the program's various constituencies in which the objectives are determined and periodically evaluated
(c) a curriculum and processes that ensure the achievement of these objectives
(d) a system of ongoing evaluation that demonstrates achievement of these objectives and uses the results to improve the effectiveness of the program.

Criterion 3. Program Outcomes and Assessment

Engineering programs must demonstrate that their graduates have:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global 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

Each program must have an assessment process with documented results. Evidence must be given that the results are applied to the further development and improvement of the program. The assessment process must demonstrate that the outcomes important to the mission of the institution and the objectives of the program, including those listed above, are being measured. Evidence that may be used includes, but is not limited to the following: student portfolios, including design projects; nationally-normed subject content examinations; alumni surveys that documents professional accomplishments and career development activities; employer surveys; and placement data of graduates.

Criterion 4. Professional Component

The professional component requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The engineering faculty must assure that the program curriculum devotes adequate attention and time to each component, consistent with the objectives of the program and institution. Students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and realistic constraints that include most of the following considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political. The professional component must include:

(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline
(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study
(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

Criterion 5. Faculty

The faculty is the heart of any educational program. The faculty must be of sufficient number; and must have the competencies to cover all the curricular areas of the program. There must be sufficient faculty to accommodate adequate levels of student-faculty interaction, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners, as well as employers of students.
The program faculty must have appropriate qualifications and must have and demonstrate sufficient authority to ensure the proper guidance of the program and to develop and implement processes for the evaluation, assessment, and continuing improvement of the program, its educational objectives and outcomes. The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and registration as Professional Engineers.

Criterion 6. Facilities

Classrooms, laboratories, and associated equipment must be adequate to accomplish the program objectives and provide an atmosphere conducive to learning. Appropriate facilities must be available to foster faculty-student interaction and to create a climate that encourages professional development and professional activities. Programs must provide opportunities for students to earn the use of modem engineering tools. Computing and information infrastructures must be in place to support the scholarly activities of the students and faculty and the educational objectives of the institution.

Criterion 7. Institutional Support and Financial Resources

Institutional support, financial resources, and constructive leadership must be adequate to assure the quality and continuity of the engineering program. Resources must be sufficient to attract, retain, and provide for the continued professional development of a well-qualified faculty. Resources also must be sufficient to acquire, maintain, and operate facilities and equipment appropriate for the engineering program. In addition, support personnel and institutional services must be adequate to meet program needs.

Criterion 8. Program Criteria

Each program must satisfy applicable Program Criteria (if any). Program Criteria provide the specificity needed for interpretation of the basic level criteria as applicable to a given discipline. Requirements stipulated in the Program Criteria are limited to the areas of curricular topics and faculty qualifications. If a program, by virtue of its title, becomes subject to two or more sets of Program Criteria, then that program must satisfy each set of Program Criteria; however, overlapping requirements need to be satisfied only once.

Appendix 3 The Ohio State University College of Engineering General Education Curriculum (GEC) Courses*

English & Communication Skills (10 hrs)

A. First Course (5 hrs)

English 110

B. Second Course (5 hrs)

African-American and African Studies 367.02, 367.03, 367.04
Agricultural Communication 367
Arabic 367
Art Education 367.01, 367.02
Comparative Studies 367.01, 367.02, 367.03, 367.04
Economics 367.01, 367.02
Engineering 367
English 367.01, 367.02, 367.03, 367.04, 367.05, 367.06, 367.07
Family & Consumer Sciences Education 367
Journalism and Communication 367
Landscape Architecture 367
Modern Greek 367
Natural Resources 367
Philosophy 367
Physics 367
Political Science 367.01
Psychology 367.01, 367.02
Slavic Languages and Literatures 367
Sociology H367.01, 367.02, H367.03
Theater 367.01, 367.02
Women's Studies 367.01, 367.04
Yiddish 367

C. Third Course (Major Department)

Aeronautical and Astronautical Engineering 510.01, 510.02 AND 510.03 (all three must be taken)
Aviation 520
Chemical Engineering 521, 630, 760, 762, AND 764 (all five must be taken)
Civil Engineering 405, 406, 460, AND 619 (all four must be taken)
Computer and Information Science 560
Electrical Engineering 582
Engineering Physics – Physics 596
FAB Engineering 225, 695, 723, 724, AND 725 (all five must be taken)
Geodetic Science 625
Industrial and Systems Engineering 500, 608.01, AND 608.02 (all three must be taken)
Materials Science and Engineering 581.01, 581.02, 581.03, 695.01, AND 695.02, 695.03 (all six must be taken)
Mechanical Engineering 564, 570, AND 581 (all three must be taken)
Welding Engineering 690, 691, 692, AND MSE 581.02 (all four must be taken)

Foreign Language (5 hrs) (Waived)

Social Diversity in the United States

African-American & African Studies 230, 551
Biology 597
English 281
Family Resource Management 362
Geography 400
History 325, 346
Linguistics 330, 361
Psychology 375
Social Work 300
Sociology 306, 382, 435, 467, 608
Speech and Hearing 310
Women's Studies 370, 510, 520

Social Sciences (9 hrs selected from two groups)

A. African-American & African Studies 101, 218
Anthropology 201, 202, 421.08
Human Development and Family Science 360, 361, 364
Journalism and Communication 101, 200, 431
Linguistics 202, 361, 365, 371
Political Science 201
Psychology 100, 371
Rural Sociology 378
Social Work 230
Sociology 210, 370, 380
Textiles and Clothing 372
Women's Studies 110

B. Economics 201
Family Resource Management 243
Geography 460, 643
International Studies 201, 230, 231, 235, 245, 250
Natural Resources 400
Political Science 100, 101, 165, 210, 245
Rural Sociology 105
Sociology 101, 345

C. Agricultural, Environmental, and Development Economics 200
Economics 110, 200
Family Resource Management 340
Geography 200, 240
International Studies 210, 215, 240
Political Science 145
Sociology 463, 466

Historical Survey (10 hrs)

African-American & African Studies 121-122
Economics 515-516
History 111-112, 121-122, 131-132, 151-152, 171-172, 181-182
Philosophy H111-H112

Arts & Humanities (9 hrs)

Literature (5 hrs)

African-American and African Studies 154, 251, 254, 271, 345, 452, 453, 551
Arabic 371, 372
Chinese 251, 501, 502, 503, 504
Classics 101, 102, 222
Comparative Studies 100, 201, 202.01, 202.02, 203, 204, 205, H240, 273, 301, 306, 308, 314
English 201, 202, 220, 260, 261, 262, 275, 280, 281, 290, 291
French 150, 151, 152
German 260.01, 260.02, 260.03, H263, 291, 292, 399
Hebrew 370, 372, 373, 374, 378
Italian 151, 152
Japanese 251, 252
Korean 251
Modern Greek 371
Near Eastern Languages & Cultures 271, 371, 372, 374
Persian 370, 371
Philosophy 215, 301, 302, 303, 304, 305, 306, 307
Russian 250
Scandinavian 222
Slavic Languages and Literatures 245
Spanish 320, 321, 520
Turkish 371, 372
Women's Studies 372
Yiddish 371, 399

Visual/Performing Arts or other Arts & Humanities (4 hrs)

African-American and African Studies 342, 385.01
Anthropology 241
Arabic 241, 377
Architecture 271[1]
Art 170, 172, 201, 240
Art Education 160, 252
Arts and Sciences 494
Chinese 231, 232
Classics 224, 225, 226, 230, 240
Comparative Studies 234, 241, 242, 270, 272, 274, 294, 305, 335, 336, 339, 345, 377
Dance 161, 200
East Asian Languages & Literatures 131, 341, 346
English H167, 270,271, 276
German 275, 299
Hebrew 216, 241, 376
History 306, 330.01, 346
History of Art 210, 211, 212, 213, 216, 240, 250, 260, 505, 515, 519, 520, 525, 530, 576
Italian 221
Japanese 231
Jewish Studies 201
Korean 231
Landscape Architecture 201
Linguistics 201, 311
Medieval and Renaissance Studies 210, 212, 213, 214, 215, 216, 217, 218, 219, 226
Modern Greek 241
Music 140, 141, 142, 150, 341, 345.01, 347, 349
Near Eastern Languages and Cultures 241, 244, 294, 311, 314, 341, 344, 351, 370
Persian 241
Philosophy 101, 130, 230, 240, H242, 270, 336
Portuguese 330
Religious Studies 270, 376
Romanian 235
Russian 135, 235
Scandinavian 520
Slavic Languages and Literatures 130
Spanish 150, 151, 322, 330, 331
Theater 100, 161, H230, 271, 280[1]
Turkish 241
Women's Studies 101, 317
Yiddish 241

University Capstone (5 hrs) (Waived)

[1]Note that this is a three credit hour course and by itself does not meet the minimum credit-hour requirement for the VPA section.

***Underlined courses indicate "social diversity" GEC must include one "social diversity" course**

6/24/2002

Appendix 4 Mapping of Goals General Education to elements of the Curriculum Model

Scale: 3 – high contribution
2 – intermediate contribution
1 – light contribution
0 or blank – not applicable to this goal

The full statements of Goals and Category of the GEC and summary of Engineering Core are shown below for convenience.

The Goals of a General Education

1. write and speak with clarity and precision so as to advance thoughts and arguments cogently and persuasively
2. read and listen critically with comprehension and intellectual curiosity
3. engage in critical analysis and logical thinking
4. understand the processes used in modes of inquiry across varying disciplines
5. understand, evaluate, and present quantitative data and symbolic terms
6. know about the forces that regulate the human life cycle and shape our environments, and understand the interactions among science, technology, the individual, and society
7. know and appreciate the diverse forms of the creative expression of human experience as articulated in literature and the visual and performing arts
8. comprehend the forces that have influenced the shaping of society and thus understand the foundations of the contemporary world in terms of both individuals and groups
9. acquire an understanding of American institutions and the pluralistic nature of American society and develop an appreciation for the range of cultural traditions that have formed and informed our nation
10. achieve an understanding of and develop an appreciation for the cultural diversity and global interdependence of the modern world
11. appreciate and understand other cultures and modes of thinking through facility with languages other than English

GEC Requirements

A. Writing and Related Skills
B. Quantitative and Logical Skills
C. Natural Science
D. Social Science
   D. i. Individuals and Groups
   D.ii. Organization and Polities
   D. iii. Human, Natural and Economic Resources
E. Arts and Humanities
   E. i. Historical Survey
   E. ii Analysis of Texts and Works of Art
F. Diversity Experience
G. Foreign Language
H. Issues of the Contemporary World

Engineering Central Core Introduction to Engineering I and II (6); Physics 131, 132 (10); Chemistry 121 (5); Math 151,152,153,254 (20)

Engineering Selected Core Nine topics intended to provide breadth for all engineering students from within the following three subsections; Additional Science, Mathematics and Statistics, General Engineering

	GEC req/GECgoal	A. Writing & related skills	B. Quant. & Logic Skills	C. Natural Science	Di. Soc Sci - Ind. & Grps	Dii. Soc Sci- Organ & Politics	Diii. Soc Sci- Human, Natural & Econ Resources	Ei. Arts & Hum.- Historic Survey	Eii. Arts & Hum- Texts&Art	F. Diversity	G. For Lang	H. Issues Contem World	Eng. Required Cent Core	Eng. Select Core	Maj Courses
1	Write & Speak	**3.00**	0.75	0.58	1.42	1.17	1.00	1.25	1.33	0.92	0.67	1.33	1.50	1.08	1.42
2	Read & Listen	1.92	1.33	1.58	**2.00**	1.92	1.92	**2.08**	**2.00**	1.58	1.08	1.92	1.83	1.83	1.92
3	Analysis & Logic	1.25	**3.00**	**2.33**	1.42	1.33	1.33	1.17	0.92	1.08	0.25	1.25	**2.75**	**2.58**	**2.83**
4	Modes of Inquiry	0.92	1.83	**2.08**	1.67	1.58	1.58	1.25	1.33	1.33	0.42	1.42	1.75	1.83	1.50
5	Quantitative Data	0.17	**3.00**	**2.33**	0.75	0.67	0.92	0.25	0.08	0.17	0.17	0.42	**2.17**	**2.25**	**2.50**
6	Interactions- Sci, Tech, Ind & Soc	0.58	0.83	1.83	1.25	1.42	1.58	0.92	0.50	0.67	0.42	1.33	1.42	1.50	1.83
7	Literature & Arts	1.67	0.25	0.08	0.42	0.33	0.50	1.42	**2.50**	0.92	0.67	0.50	0.25	0.33	0.33
8	Shaping of Soc	0.50	0.50	0.67	**2.17**	**2.50**	**2.33**	1.67	0.83	1.75	0.58	**2.17**	0.58	0.58	0.58
9	American Institutions	0.58	0.33	0.25	**2.08**	**2.67**	**2.25**	1.83	1.25	1.83	0.08	1.58	0.25	0.25	0.25
10	Diversity & interdependence	0.67	0.17	0.33	**2.00**	**2.17**	1.58	1.67	1.00	**2.92**	0.92	1.83	0.33	0.33	0.33
11	Cultures & modes of thinking	0.42	0.17	0.25	0.58	0.67	0.50	0.67	0.75	1.00	**2.58**	0.83	0.33	0.33	0.42

Appendix 5 Mapping of Goals of General Education to Elements of the ASEE Model

Scale: 3 – high contribution
2 – intermediate contribution
1 – light contribution
0 or blank – not applicable to this goal

The full statements of Goals and Category of the GEC and summary of the four broad categories in the ASEE White Paper are shown below.

The Goals of a General Education

1. write and speak with clarity and precision so as to advance thoughts and arguments cogently and persuasively
2. read and listen critically with comprehension and intellectual curiosity
3. engage in critical analysis and logical thinking
4. understand the processes used in modes of inquiry across varying disciplines
5. understand, evaluate, and present quantitative data and symbolic terms
6. know about the forces that regulate the human life cycle and shape our environments, and understand the interactions among science, technology, the individual, and society
7. know and appreciate the diverse forms of the creative expression of human experience as articulated in literature and the visual and performing arts.
8. comprehend the forces that have influenced the shaping of society and thus understand the foundations of the contemporary world in terms of both individuals and groups
9. acquire an understanding of American institutions and the pluralistic nature of American society and develop an appreciation for the range of cultural traditions that have formed and informed our nation
10. achieve an understanding of and develop an appreciation for the cultural diversity and global interdependence of the modern world
11. appreciate and understand other cultures and modes of thinking through facility with languages other than English

ASEE Four Broad Categories:

1. Communication
   - 1.1. Critical thinking skills
   - 1.2. Communication strategies
   - 1.3. Fundamental writing and presentation skills
   - 1.4. Fundamental speaking and presentation skills
2. Professional Responsibility
   - 2.1. Professional organization
   - 2.2. Professional codes of conduct
   - 2.3. Professional regulation
   - 2.4. Personal values
3. Technology and Culture
   - 3.1. History of science and technology
   - 3.2. An introduction to STS (science, technology, and society) studies
   - 3.3. Contemporary issues
   - 3.4. Social ideals and values
4. Intellectual and Cultural Perspectives
   - 4.1. Fundamental assumptions about the nature of reality and being
   - 4.2. Ways of knowing
   - 4.3. Politics, society, and cultures

		Communication				Professional Responsibility					Technology and Culture				Intellectual and Cultural Perspectives		
	ASEE Cat/GEC goal	Critical Thinking	comm Strat	Writing & Pres	Speaking & pres	Prof org	Prof codes of conduct	prof reg	ethical rea.	personal values	hist of sci & tech	STS studies	Conte. Issues	Soc ideas & values	reality & being	Ways of knowing	Politics, , soc & cult
1	Write & Speak	1.64	**2.82**	**3.00**	**2.64**	0.55	0.45	0.55	0.91	0.91	0.55	0.64	0.73	0.73	0.91	0.82	0.64
2	Read & Listen	**2.27**	**2.00**	1.00	1.27	0.55	1.00	0.91	1.09	0.73	1.45	1.55	1.36	1.36	1.36	1.55	1.18
3	Analysis & Logic	**3.00**	1.91	1.64	1.18	0.36	1.09	1.00	1.73	1.09	0.91	1.09	1.00	1.00	1.91	1.73	1.18
4	Modes of Inquiry	**2.00**	1.64	0.45	0.36	0.27	0.45	0.73	0.55	0.36	1.09	1.45	1.09	1.18	1.45	**2.64**	1.18
5	Quantitative Data	**2.18**	1.09	0.82	0.73	0.18	0.27	0.64	0.27	0.09	0.45	1.00	0.45	0.36	0.36	0.55	0.45
6	Interactions-Sci, Tech, Ind & Soc	1.00	0.73	0.55	0.55	1.00	1.00	1.00	1.55	1.27	**2.45**	**2.36**	1.82	1.90	1.27	0.91	1.64
7	Literature & Arts	1.00	0.64	1.00	0.64	0.18	0.18	0.18	0.55	1.09	0.36	0.36	1.00	1.36	1.36	1.27	0.91
8	Shaping of Soc	1.09	0.64	0.55	0.45	1.09	1.09	1.18	1.27	0.91	**2.18**	1.64	**2.09**	**2.18**	1.18	1.09	**2.36**
9	American Institutions	0.73	0.55	0.36	0.36	1.09	0.64	0.91	0.82	0.82	1.55	1.18	**2.36**	1.64	0.55	0.55	**2.36**
10	Diversity & interdependence	0.73	0.82	0.55	0.27	0.82	0.64	0.73	1.00	1.00	0.36	0.73	**2.18**	**2.09**	1.00	0.91	**2.27**
11	Cultures & modes of thinking	0.36	0.91	0.82	0.73	0.36	0.36	0.18	0.27	0.18	0.36	0.18	0.64	0.64	0.64	0.36	0.82

Appendix 6 Memo to UCRC Committee on Report

January 12, 2003

Professor Marilyn Blackwell
Department of Germanic Languages and Literatures
314 Cunz Hall
1841 Millikin Road
Campus

Dear Prof. Blackwell:

I am the chair of the Engineering Core Curriculum and College Services Committee. We discussed the report of the Undergraduate Curriculum Committee on the General Education Curriculum and Time to Degree (the GEC report) at several of our meetings in autumn quarter. I am writing to inform you of the committee's opinions on two issues in the report.

One of the exercises our committee performed as part of our study was to map the Goals of General Education from Section IV.B. of the report onto the various GEC requirements, different aspects of the College of Engineering requirements, and major courses. That is, we tried to identify which parts of the curriculum meet each of the goals. We did this first as individuals, and then as a committee. In compiling the results there were features for which there were differences of opinion and others for which there was wide agreement across the committee. A problem area that was identified pertained to goal 6 in section IV.B. That goal states that a curriculum should prepare /enable students to: "know about the forces that regulate the human life cycle and shape our environments and our universe, and understand the interactions among science, technology, the universe, the individual and society." While we were able to identify various portions of the curriculum that provide dilute contributions to this goal, including elements in the College of Engineering and in the students' majors, there do not seem to be any clear principle curriculum elements that contribute to this goal. For the other goals we were able to identify such principal curriculum elements. This situation may need further study to clarify.

Our committee also read *Recommendations for Liberal Education in Engineering: A White Paper from the Liberal Education Division of the American Society for Engineering Education*[1]. A copy of the white paper is enclosed. While we found many parallels between the Goals of General Education in the GEC report and the recommendations in this white paper, we found the goals in the GEC report to be lacking regarding preparing students in the area of professional responsibility. We feel that this is important for all students, and warrants further study as an element of the GEC.

We thank the Undergraduate Curriculum Committee on the General Education Curriculum and Time to Degree for all of your work on these important issues, and for asking for feedback on your report. GEC issues will be on the agenda of many of our committee's

[1] Nicholas H. Steneck, Barbara M. Olds, Kathryn A. Neely, Proceedings of the 2002 American Society for Engineering Education Annual Conference and Exposition, Montréal, Quebec Canada , June 16-19, 2002.

meetings the rest of this academic year. If you have questions about our committees views or desire further input from our committee on these or other GEC issues please feel free to contact me.

Sincerely,

George J. Valco
Associate Professor
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Appendix 7 GEC LA Course Enrollment Patterns for Recent Graduates

2nd Writing	Total			Percent			Popular Subjects			
Course	**All**	**Reg**	**Honors**	**All**	**Reg**	**Honors**	**Subject**	**All**	**Reg**	**Honors**
African-American and African Studies 367.03	2	2	0	1.2%	1.8%	0.0%	English	53.3%	54.5%	50.9%
African-American and African Studies 367.04	3	3	0	1.8%	2.7%	0.0%	Comparative Studies	8.9%	11.6%	3.5%
Agricultural Communication 367	6	5	1	3.6%	4.5%	1.8%				
Arabic 367	1	1	0	0.6%	0.9%	0.0%				
Art Education 367.01	6	4	2	3.6%	3.6%	3.5%				
Communication 305	3	1	2	1.8%	0.9%	3.5%				
Comparative Studies 367.01	10	9	1	5.9%	8.0%	1.8%				
Comparative Studies 367.02	5	4	1	3.0%	3.6%	1.8%				
Economics 367.01	1	1	0	0.6%	0.9%	0.0%				
Engineering 367	9	5	4	5.3%	4.5%	7.0%				
English 367.01	69	50	19	40.8%	44.6%	33.3%				
English 367.02	13	6	7	7.7%	5.4%	12.3%				
English 367.03	1	1	0	0.6%	0.9%	0.0%				
English 367.04	4	2	2	2.4%	1.8%	3.5%				
English 367.05	3	2	1	1.8%	1.8%	1.8%				
Journalism and Communication 305	3	0	3	1.8%	0.0%	5.3%				
Natural Resources 367	5	3	2	3.0%	2.7%	3.5%				
Philosophy 367	8	5	3	4.7%	4.5%	5.3%				
Physics 367	1	0	1	0.6%	0.0%	1.8%				
Psychology 367.01	7	4	3	4.1%	3.6%	5.3%				
Slavic 367	2	1	1	1.2%	0.9%	1.8%				
Sociology 367.02	1	0	1	0.6%	0.0%	1.8%				
Theater 367.01	1	1	0	0.6%	0.9%	0.0%				
Women's Studies 367.01	2	1	1	1.2%	0.9%	1.8%				
Women's Studies 367.04	1	1	0	0.6%	0.9%	0.0%				
Yiddish 367	2	0	2	1.2%	0.0%	3.5%				
Total Students	169	112	57							

Social Diversity	Total			Percent			Popular Subjects			
Course	**All**	**Reg**	**Honors**	**All**	**Reg**	**Honors**	**Subject**	**All**	**Reg**	**Honors**
African-American and African Studies 367.03	2	2	0	1.2%	1.7%	0.0%	English	37.6%	33.1%	49.0%
African-American and African Studies 367.04	3	3	0	1.8%	2.5%	0.0%	Sociology	37.1%	38.8%	32.7%
Agricultural Communication 367	4	3	1	2.4%	2.5%	2.0%	Comparative Studies	7.6%	9.9%	2.0%
Arabic 367	1	1	0	0.6%	0.8%	0.0%				
Art Education 367.01	4	3	1	2.4%	2.5%	2.0%				
Comparative Studies 367.01	4	4	0	2.4%	3.3%	0.0%				
Comparative Studies 367.02	9	8	1	5.3%	6.6%	2.0%				
English 281	3	2	1	1.8%	1.7%	2.0%				
English 367.01	47	31	16	27.6%	25.6%	32.7%				
English 367.02	9	4	5	5.3%	3.3%	10.2%				
English 367.03	1	1	0	0.6%	0.8%	0.0%				
English 367.04	2	1	1	1.2%	0.8%	2.0%				
English 367.05	2	1	1	1.2%	0.8%	2.0%				
Philosophy 367	6	3	3	3.5%	2.5%	6.1%				
Rural Sociology 105	8	5	3	4.7%	4.1%	6.1%				
Slavic 367	2	1	1	1.2%	0.8%	2.0%				
Sociology 101	55	42	13	32.4%	34.7%	26.5%				
Theatre 367.01	2	2	0	1.2%	1.7%	0.0%				
Women's Studies 201	3	1	2	1.8%	0.8%	4.1%				
Women's Studies 210	1	1	0	0.6%	0.8%	0.0%				
Women's Studies 367.01	1	1	0	0.6%	0.8%	0.0%				
Women's Studies 367.04	1	1	0	0.6%	0.8%	0.0%				
Total Students	170	121	49							

Social Sciences	Total			Percent			Popular Subjects			
Course (2 taken by students)	**All**	**Reg**	**Honors**	**All**	**Reg**	**Honors**	**Subject**	**All**	**Reg**	**Honors**
Individuals and Groups										
African-American and Afri Studies 101	3	3	0	0.9%	1.2%	0.0%	Economics	30.6%	30.4%	31.3%
Anthropology 201	4	2	2	1.2%	0.8%	2.1%	Psychology	26.6%	26.8%	26.0%
Anthropology 202	5	2	3	1.4%	0.8%	3.1%	Sociology	21.4%	21.6%	20.8%
Human Devel and Family Science 361	1	0	1	0.3%	0.0%	1.0%	Political Science	7.8%	7.6%	8.3%
Journalism and Communication 200	1	1	0	0.3%	0.4%	0.0%				
Natural Resources 400	1	1	0	0.3%	0.4%	0.0%				
Political Science 201	1	1	0	0.3%	0.4%	0.0%				
Psychology 100	92	67	25	26.6%	26.8%	26.0%				
Sociology 210	2	1	1	0.6%	0.4%	1.0%				
Women's Studies 210	2	2	0	0.6%	0.8%	0.0%				
Organizations and Polities										
Economics 201	19	13	6	5.5%	5.2%	6.3%				
Economics 400	2	0	2	0.6%	0.0%	2.1%				
International Studies 201	4	3	1	1.2%	1.2%	1.0%				
International studies 230	1	1	0	0.3%	0.4%	0.0%				
International Studies 250	1	1	0	0.3%	0.4%	0.0%				
Political Science 100	7	4	3	2.0%	1.6%	3.1%				
Political Science 101	15	10	5	4.3%	4.0%	5.2%				
Political Science 210	1	1	0	0.3%	0.4%	0.0%				
Rural Sociology 105	9	7	2	2.6%	2.8%	2.1%				
Sociology 101	62	46	16	17.9%	18.4%	16.7%				
Human, Natural and Econ Resources										
Agricultural Economics 200	4	3	1	1.2%	1.2%	1.0%				
Economics 200	85	63	22	24.6%	25.2%	22.9%				
Family Resource Management 243	1	1	0	0.3%	0.4%	0.0%				
Geography 200	18	13	5	5.2%	5.2%	5.2%				
Geography 240	1	1	0	0.3%	0.4%	0.0%				
Political Science 145	3	3	0	0.9%	1.2%	0.0%				
Sociology 463	1	0	1	0.3%	0.0%	1.0%				
Total Students	346	250	96							

Historical Survey	Total			Percent			Popular Subjects			
Course	**All**	**Reg**	**Honors**	**All**	**Reg**	**Honors**	**Subject**	**All**	**Reg**	**Honors**
AFAM 121/122	4	4	0	2.3%	3.3%	0.0%	History 151/152	64.3%	65.9%	60.4%
Economics 515/516	4	1	3	2.3%	0.8%	6.3%	History 111/112	26.3%	27.6%	22.9%
History 111/112	45	34	11	26.3%	27.6%	22.9%				
History 131/132	3	2	1	1.8%	1.6%	2.1%				
History 151/152	110	81	29	64.3%	65.9%	60.4%				
History 171/172	2	0	2	1.2%	0.0%	4.2%				
History 181/182	1	0	1	0.6%	0.0%	2.1%				
Philosophy H111/H112	2	1	1	1.2%	0.8%	2.1%				
Total Students	171	123	48							

Literature	Total			Percent			Popular Subjects			
Course	All	Reg	Honors	All	Reg	Honors	Subject	All	Reg	Honors
African-American and African Studies 154	4	4	0	2.3%	3.3%	0.0%	Classics	33.7%	35.0%	30.6%
African-American and African Studies 251	2	2	0	1.2%	1.6%	0.0%	English	26.7%	27.6%	24.5%
African-American and African Studies 345	1	1	0	0.6%	0.8%	0.0%	Ethnic Literatures	15.7%	14.6%	18.4%
African-American and African Studies 551	1	1	0	0.6%	0.8%	0.0%	Comparative Studies	12.8%	9.8%	20.4%
Anthropology 201	1	0	1	0.6%	0.0%	2.0%	Philosophy	5.2%	5.7%	4.1%
Arabic 372	1	1	0	0.6%	0.8%	0.0%				
Chinese 251	6	5	1	3.5%	4.1%	2.0%				
Classics 101	12	9	3	7.0%	7.3%	6.1%				
Classics 102	1	1	0	0.6%	0.8%	0.0%				
Classics 222	45	33	12	26.2%	26.8%	24.5%				
Comparative Studies 100	11	5	6	6.4%	4.1%	12.2%				
Comparative Studies 201	2	2	0	1.2%	1.6%	0.0%				
Comparative Studies 202.02	2	0	2	1.2%	0.0%	4.1%				
Comparative Studies 204	1	0	1	0.6%	0.0%	2.0%				
Comparative Studies 270	4	4	0	2.3%	3.3%	0.0%				
Comparative Studies 301	2	1	1	1.2%	0.8%	2.0%				
English 201	2	2	0	1.2%	1.6%	0.0%				
English 202	2	2	0	1.2%	1.6%	0.0%				
English 220	8	7	1	4.7%	5.7%	2.0%				
English 260	8	8	0	4.7%	6.5%	0.0%				
English 261	15	8	7	8.7%	6.5%	14.3%				
English 262	1	1	0	0.6%	0.8%	0.0%				
English 275	1	1	0	0.6%	0.8%	0.0%				
English 280	3	1	2	1.7%	0.8%	4.1%				
English 281	3	2	1	1.7%	1.6%	2.0%				
English 290	1	0	1	0.6%	0.0%	2.0%				
English 291	2	2	0	1.2%	1.6%	0.0%				
French 150	1	1	0	0.6%	0.8%	0.0%				
French 151	2	2	0	1.2%	1.6%	0.0%				
German 260.02	1	0	1	0.6%	0.0%	2.0%				
German 260.03	1	1	0	0.6%	0.8%	0.0%				

Hebrew 370	4	1	3	2.3%	0.8%	6.1%				
Japanese 251	4	3	1	2.3%	2.4%	2.0%				
Japanese 252	1	1	0	0.6%	0.8%	0.0%				
Modern Greek 371	1	1	0	0.6%	0.8%	0.0%				
NELC 372	1	1	0	0.6%	0.8%	0.0%				
Philosophy 101	1	1	0	0.6%	0.8%	0.0%				
Philosophy 215	2	1	1	1.2%	0.8%	2.0%				
Philosophy 301	3	2	1	1.7%	1.6%	2.0%				
Philosophy 303	2	2	0	1.2%	1.6%	0.0%				
Philosophy 305	1	1	0	0.6%	0.8%	0.0%				
Russian 250	3	2	1	1.7%	1.6%	2.0%				
Spanish 320	1	0	1	0.6%	0.0%	2.0%				
Turkish 372	1	0	1	0.6%	0.0%	2.0%				
Total Students	172	123	49							

Visual/Performing Arts	Total			Percent			Popular Subjects			
Course	**All**	**Reg**	**Honors**	**All**	**Reg**	**Honors**	**Subject**	**All**	**Reg**	**Honors**
Arabic 241	1	1	0	0.6%	0.8%	0.0%	Philosophy	26.5%	27.9%	22.9%
Art	1	1	0	0.6%	0.8%	0.0%	Theater	17.1%	15.6%	20.8%
Art 170	7	5	2	4.1%	4.1%	4.2%	Art/ Art Education	10.6%	10.7%	10.4%
Art 201	5	3	2	2.9%	2.5%	4.2%	Music	6.5%	4.9%	10.4%
Art Education 160	4	4	0	2.4%	3.3%	0.0%	Linguistics	5.9%	5.7%	6.3%
Art Education 367.02	1	0	1	0.6%	0.0%	2.1%				
Chinese 232	1	1	0	0.6%	0.8%	0.0%				
Classics 225	1	0	1	0.6%	0.0%	2.1%				
Comparative Studies 358	1	0	1	0.6%	0.0%	2.1%				
EALL 131	22	18	4	12.9%	14.8%	8.3%				
English 263	1	1	0	0.6%	0.8%	0.0%				
English 270	1	1	0	0.6%	0.8%	0.0%				
English 373	1	0	1	0.6%	0.0%	2.1%				
German 299	3	3	0	1.8%	2.5%	0.0%				
History 306	1	0	1	0.6%	0.0%	2.1%				
History of Art 201	0	0	0	0.0%	0.0%	0.0%				
History of Art 210	2	1	1	1.2%	0.8%	2.1%				
History of Art 211	2	2	0	1.2%	1.6%	0.0%				
History of Art 212	1	1	0	0.6%	0.8%	0.0%				
History of Art 213	1	0	1	0.6%	0.0%	2.1%				
History of Art 216	1	1	0	0.6%	0.8%	0.0%				
History of Art 260	1	1	0	0.6%	0.8%	0.0%				
Japanese 231	1	1	0	0.6%	0.8%	0.0%				
Landscape Architecture 201	3	2	1	1.8%	1.6%	2.1%				
Linguistics 201	10	7	3	5.9%	5.7%	6.3%				
Medieval and Renaissance Studies 210	1	1	0	0.6%	0.8%	0.0%				
Music 140	8	5	3	4.7%	4.1%	6.3%				
Music 141	2	0	2	1.2%	0.0%	4.2%				
Music 142	1	1	0	0.6%	0.8%	0.0%				

Philosophy 101	26	21	5	15.3%	17.2%	10.4%				
Philosophy 130	16	11	5	9.4%	9.0%	10.4%				
Philosophy 270	2	1	1	1.2%	0.8%	2.1%				
Philosophy 276	1	1	0	0.6%	0.8%	0.0%				
Religious Studies 270	2	2	0	1.2%	1.6%	0.0%				
Russian 135	1	0	1	0.6%	0.0%	2.1%				
Slavic 130	1	1	0	0.6%	0.8%	0.0%				
Spanish 150	1	1	0	0.6%	0.8%	0.0%				
Theater 100	27	18	9	15.9%	14.8%	18.8%				
Theater 271	1	1	0	0.6%	0.8%	0.0%				
Theater 280	1	0	1	0.6%	0.0%	2.1%				
Women's Studies 201	6	4	2	3.5%	3.3%	4.2%				
Total Students	170	122	48							

Appendix 8 Ethics and Professionalism Supporting Materials

8.1 Ethics and Professionalism in the Curriculum Draft 5/12/03

Ohio State University
College of Engineering

Ethics and Professionalism

The practice of engineering poses challenging ethical questions for which a working knowledge of ethics and professionalism is critical to the engineer. "Engineers must be aware of their social responsibilities and equip themselves to reflect critically on the moral dilemmas they will confront."[1] Engineering codes of ethics call on engineers to "perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct" [2] It is understood that unethical and unprofessional acts are never victimless[3] and engineers "hold paramount the safety, health and welfare of the public."[2] Recent outcomes assessment demonstrate that this is both an area of importance in engineering education and an area where improvement in the curriculum needs to be considered.[7][8][10]

Goals

One of the curriculum goals of the College of Engineering is to ensure that our graduates have a firm foundation in ethics and professionalism. This goal is based on input from both the university and the Accreditation Board for Engineering and Technology's (ABET), our accrediting institution. The Goals of a University Education at OSU includes the statement that "Central to an excellent university education is the acquisition by students of certain desirable habits of mind, such as the capacity to make informed and discriminating ethical judgments." [5] In addition, the ABET's criteria for accrediting engineering programs has carried a requirement for ethics in the curriculum for many years. Currently, Criterion 3f states, "Engineering programs must demonstrate that their graduates have an understanding of professional and ethical responsibility."[6] These two goals are mutually supportive, reach across discipline boundaries, and are needed by the professional engineer.

Learning Objectives

An engineering student's education combines liberal[2] and professional elements. There is a need for both elements to contribute to ethical and professional education. The American Society for Engineering Education has developed a list of learning objectives that combine both of these elements. [9] Their list is shown below along with those elements of the curriculum with the committee's opinion of the primary (P) and secondary (S) responsibility for achieving the objective.

[2] As defined by [4] "A liberal education is a practical education because it develops just those capacities needed by every thinking adult: analytical skills, effective communication, practical intelligence, ethical judgment, and social responsibility"

Objective	How To Achieve		
	Engineering GEC	Engineering Core	Major
1. Professional organization			
• An ability to define the concept of "professionalism" and "professional responsibility"		S	P
• An ability to describe the emergence of engineering as a profession		P	
• Knowledge of the major professional organizations that are relevant to engineers		S	P
2. Professional codes of conduct			
• General knowledge of one or more general engineering codes, such as the NSPE Code		P	S
• An ability to apply special engineering codes that are relevant to a student's field of interest to real engineering problems			P
3. Professional regulation			
• An ability to describe the different settings in which engineers work and the regulations that govern these settings		S	P
• An ability to explain the ways in which society regulates the use of technology	P		
• An ability to explain the ways safety standards are set			P
4. Ethical reasoning			
• An ability to identify stakeholders in an engineering solution	S	S	P
• An ability to identify moral problems and dilemmas	P	S	
• An ability to analyze moral problems from different ethical perspectives	P	S	
5. Personal values			
• An ability to identify the personal values that the student holds and uses to resolve moral problems and dilemmas	P		
• An ability to describe the relationship between personal values, social values, and professional values	P		

[1] Martin, Mike, and Roland Schinzinger, Ethics in Engineering, The McGraw-Hill Companies, Inc., New York, 1996.

[2] National Society of Professional Engineers, December 2001. Ethics. Internet: http://www.nspe.org/ethics/.
[3] Montor, Karel, Ethics for the Junior Officer, Naval Institute Press, Annapolis, MD, 1994.
[4] Greater Expectations, National Panel Report, Assocation of American Colleges and Universities, 2002.
[5] OSU Goals for Educated Person
[6] Accreditation Board for Engineering and Technology's Accreditation Document. Internet: http://www.abet.org/accreditation.html
[7] Gustafson, Robert and Ed McCaul "Four Years of Senior and Alumni Surveys – What Have We Learned" Paper presented at the American Society for Engineering Education North Central Section April 2003 Conference
[8] Gustafson, Robert, Earl Whitlatch, and Ed McCaul, ASEE 2003 Meeting paper "Alumni Perspectives on Professional and Ethical Responsibility" Proceedings of the 2003 American Society of Engineering Education Annual Conference & Exposition.
[9] Steneck, Nicholas, Barbara M. Olds, and Kathryn A. Neeley, "Recommendation for Liberal Education in Engineering: A White Paper from the Liberal Education Division of the American Society for Engineering Education", Proceedings of the 2002 American Society for Engineering Education Annual Conference & Exposition.
[10] "Annual Progress and Planning Report for Engineering Undergraduate Programs" an annual report published by the College of Engineering's Outcomes Assessment Committee.

8.2 The College of Engineering Ethics & Professionalism Course Review Procedures

The Core Curriculum and UG Services (Core) Committee will serve as the approval and review body for all courses that constitute the approved list of Ethics & Professionalism courses for the College of Engineering GEC.

Approval Process

1. The course must be approved as a course in the regular manner through the University's Office of Academic Affairs, but can be considered by the Review Panel prior to final approval by OAA. Approval for the category will be contingent on final approval by OAA.
2. A copy of the syllabus must be submitted along with a cover letter and other explanatory material to the College of Engineering's Office of Academic Affairs attention Program Director for Academic Affairs and Student Services.
3. The course will be considered for inclusion on the list of approved courses by the Ethics & Professional Subcommittee of the Core Committee based on the published guidelines approved by the core committee.
4. The Ethics & Professional Subcommittee will make a recommendation to the full committee which will then vote on whether the course should be included on the approved list of courses.

Review Process

1. The Ethics & Professional Subcommittee of the Core Curriculum and UG Services Committee will be responsible for reviewing all of the courses on the approved list at least once every five years to determine if each of the courses still meets the objectives as stated in published guidelines.
2. The Ethics & Professional Subcommittee will report to the full committee on its findings and the committee will vote on whether the list should be amended.

Ethics & Professional Subcommittee Membership

1. The subcommittee will consist of no less than four members.
2. Faculty members will be appointed by the Chair of the Core Committee for three-year terms. One member shall be from outside of the College of Engineering based on recommendation of the Chair of the Colleges of the Arts and Sciences Curriculum Committee. A student member shall be appointed annually to the Subcommittee by the Dean or the Dean's designee.
3. The chair of the subcommittee will be appointed annually by the Chair of the Core Committee.

8.3 Guidelines for Approval and Re-evaluation of Ethics & Professionalism Courses in the College of Engineering

As expressed in the Engineering GEC model, engineers must have an understanding of ethics and professionalism both within professional practice and life activities in general. It is recognized that the engineering curriculum has multiple elements contributing to the development of students in this area. The College of Engineering will be responsible for dealing with the ethical and professionalism issues specific to engineering in both the engineering core and major. It is expected that Ethics & Professionalism courses as part of the Engineering GEC will deal with ethical and professional issues relevant to engineering education but in a larger context. The general learning objectives for GEC courses are that upon completion engineering students will be able to have:

1. An ability to explain the ways in which society regulates the use of technology
2. An ability to identify stakeholders in an engineering solution
3. An ability to identify moral problems and dilemmas
4. An ability to analyze moral problems from different ethical perspectives
5. An ability to identify the personal values that the student holds and uses to resolve moral problems and dilemmas
6. An ability to describe the relationship between personal values, social values, and professional values

<u>Guidelines for initial evaluation of courses</u>

1. Courses, while not being required to assists students in meeting all of the stated goals, must contribute to a majority of them.
2. Programs submitting a course for approval should state and show evidence for which of the goals the course addresses.
3. Courses should be proposed in a format that will fully support students meeting the stated goals.

<u>Guideline for re-evaluation of courses</u>

1. Courses currently being offered in this category may be periodically asked to submit a current syllabus for the course, representative work of the class (papers, exercises, exams), and other evidence supporting contribution of the course to the goals listed.
2. Student evaluations and other data may be collected and considered by the subcommittee in its deliberations.
3. Based on the learning objectives listed for the course, the Ethics and Professionalism Subcommittee will develop a recommendation as to continuation of the course in the category to be acted on by the full Core Committee.

8.3 Letters from Potential Offering Units (to be added)

Appendix 9 Course Syllabus, ENGINEER 181, Introduction to Engineering – I, 2003

Course Meeting Times and Places:

9:30 – 11:18 p.m.	T	Room 224 HI	Basics Skills
9:30 – 11:18 p.m.	R	Room 214 HI	Hands-on Laboratory
9:30 – 11:18 p.m.	R	Room 216 HI	Hands-on Laboratory
10:30 – 11:18 p.m.	F	Room 224 HI	Basics Skills

Instructional Team:

	Name	Office	Office Phone	Email
Instructor:				
Lab Instructors:				
Teaching Assistants:				
Peer Mentors:				

Course Objectives: This course is designed to help students develop an understanding and appreciation of engineering, the problems solved and contributions made by engineers from various disciplines, and the engineering design process. Students will learn and practice fundamental skills useful to engineering students and professional engineers in many fields. In addition, students will develop their study skills and improve their understanding of material in their technical courses during the teamwork portion of the course. This course is divided into two segments: (1) Basic Skills and (2) Hands-on Laboratory.

Basic Skills: Each week, students will be introduced to skills important to most engineers and given an opportunity to practice those skills. Homework assignments will be made in each session and will be due on the date indicated on the syllabus. Each session's assignment is worth a maximum of 20 points if turned in on time and 14 points if turned in by the beginning of the next session. Papers received more than one session late will be marked but will not earn credit.

Rework or Redo Policy for Homework:

A. If a grade is less than 14, student has the option to redo the assignment.
B. The redo must be turned in at the beginning of the next Basics lecture.
C. The redone work should be accompanied by the original graded assignment.
D. If not turned in, the original grade stands.
E. Maximum score on redone work is 14.
F. Score on the redone work cannot be less than the original score.
G. Late assignment cannot be redone.

One mid-term exam and one final exam will be given. Exams are given closed book, closed notes, closed outside resources unless otherwise stated at the time of the exam. Note: No food or beverages are allowed in the classrooms.

Time is routinely reserved for students to work in teams on assignments, lab reports or pre-labs (or on topics from related courses, such as Math). The instructional team will move among the groups, coaching students on approaches to the problems, helping students to understand important concepts, and suggesting useful references as needed. Topics for group discussion may be concepts presented in one of the technical courses or assigned problems from those courses.

Hands-On Laboratory: Each week students will attend one 2-hour Hands-on Laboratory session. There will be three sets of labs. The first, Fundamental Concepts, consists of labs 2, 3, and 4. The second sequence, Ice Cream, will consist of labs 5 and 6. The third and final, Camera Labs, consists of labs 7, 8, & 9. During the 10^{th} and final lab, each team will make an oral presentation on an engineering discipline. During the laboratory sessions, students will perform a variety of hands-on activities including disassembling and reassembling objects, testing components, and collecting and analyzing

data. Homework assignments will include gathering additional information from the internet or library, solving problems related to the lab work, and preparing lab reports. Students will also prepare and present an oral report. Each assignment will be graded. A few questions on important concepts covered in the laboratories will be included on the final exam. There may be time in the second half of your two-hour Basics sessions for teams to work on lab reports and pre-lab work, where required.

The contribution of each course segment to the overall course grade is as follows:

Basic Skills	**20%**
• Daily assignments	19%
• Journal Entries	1%
Hands-on Laboratory	**30%**
• Weekly assignments	20%
• Oral presentation	10%
Midterm Exam	**20%**
Final Exam	**30%**
Total	**100%**

Attendance is mandatory for all components (Basic Skills, Teamwork and Hands-On Laboratory). Students are subject to losing points for absences unless prior approval is obtained from your Basics Instructor or Teaching Assistant.

Academic Misconduct such as cheating or plagiarism will be reported using official University procedures. Policies and procedures can be found in a Synopsis of the Code of Student Conduct included in each quarter's Master Schedule Book. The Code of Conduct is printed in the Student Handbook and Student Telephone Directory. Copies may be obtained from the Office of Student Judicial Affairs, 2050 Drake Union.

- All cases of suspected misconduct must be reported to the University Committee on Misconduct. Any students observing misconduct should report such to the course instructor.
- The Code of Student Conduct defines Academic misconduct to include
    - Violation of course rules,
    - Providing or receiving information during quizzes or exams,
    - Submitting plagiarized work,
    - Falsification, fabrication, or dishonest in reporting research results.
- Students should be encouraged to go to their Eng 100 materials to learn more about the process. Many will have the Landis book Studying Engineering. They can be encouraged to read the section p. 266 – 269 for a discussion of what is misconduct.
- They need to know that faculty are obligated to report all misconduct cases to the University Committee on Academic Misconduct. This is not an option.
- For purposes of Academic misconduct, the Associate Dean for Academic Affairs will act as the Department Chair in any reported cases.
- Need to be clear that we encourage collaboration among students. However, work turned in as an individual must be the product of that person.

A Test Faculty May Use to Determine Individual Product

1. Can you explain and demonstrate how you did each step or element of a problem or exercise.
2. Does the work show it in your own words and terms?
3. Work together to understand concepts and explain things to each other.
4. Have each person do the end product for themselves as an individual.

Official Ohio State Academic Misconduct Code
Committee on Academic Misconduct
1.0 Academic Misconduct (3335-31-02)
Academic misconduct is defined as any activity which tends to compromise the academic integrity of the institution, or subvert the educational process. Examples of academic misconduct include, but are not limited to:

A. violation of course rules as contained in the course syllabus or other information provided the student; violation of program regulations as established by departmental committees;
B. providing or receiving information during quizzes and examinations such as course examinations and general examinations; or providing or using unauthorized assistance in the laboratory, at the computer terminal, or on field work;
C. submitting plagiarized work for an academic requirement. Plagiarism is the representation of another's works or ideas as one's own; it includes the unacknowledged word for word use and/or paraphrasing of another person's work, and/or the inappropriate unacknowledged use of another person's ideas;
D. falsification, fabrication, or dishonesty in reporting research results;
E. serving as, or enlisting the assistance of, a "ringer" or substitute for a student in the taking of examinations;
F. alteration of grades or marks by the student in an effort to change the earned grade or credit; and
G. alteration of University forms used to drop or add courses to a program, or unauthorized use of those forms

Source: http://www.osu.edu/offices/oaa/procedures/1.0.html

Students with Disabilities: Course materials and exercises can be made available in alternative formats. Please contact the instructor or the Office for Disability Services (292-3307) for further information.

Test accommodations may include:
- distraction reduced environments
- a computer or adaptive equipment
- reader or scribe
- extended time
- alternate formats (taped, brailled or enlarged exams)

ODS facilitates exam accommodations in cooperation with instructors. To make exam accommodations:

Meet with your instructor(s) at the beginning of each quarter to discuss your disability and exam accommodation arrangements. Your instructor(s) may choose to provide you with the appropriate exam accommodation(s) in the classroom or at another site under his/her supervision.

For exam accommodations through ODS
- Obtain "Proctor Checklist" from ODS for each course (see Appendix A, pages 43 & 44). New Proctor Checklists must be obtained each quarter. They do not transfer from quarter to quarter.
- Have instructor fill out the "Proctor Checklist" completely including signatures required (refer to specific instructions on the back of the form). Incomplete checklists may result in exams not being scheduled.
- Give instructor the pink copy of the checklist after being completed and before bringing the white and yellow copies to ODS.
- Mark on the checklist(s) the accommodations that are appropriate for each exam. Accommodations may not be made available to you on the day of the exam if you did not indicate them on the checklist(s).
- Personally bring (do not mail) all completed Proctor Checklists to ODS at the beginning of each quarter to schedule exams for the entire quarter or at least within five days of your exam or quiz. You are more likely to get your accommodations, equipment, or space that you need.

To reschedule an exam:
- Obtain "Rescheduling Authorization Form" from ODS (see Appendix A, Page 45).
- Have instructor fill out and sign the form.
- Return to ODS as soon as possible for scheduling.

Failure to notify ODS of cancellations or changes of scheduled exam times subjects you to possible loss of exam accommodations through ODS. Please refer to the "Policy for No Show, Lateness, or Illness" for detailed information.

SOURCE: http://www.ods.ohio-state.edu/ods/directory/exam/policy.htm

Course Materials: The following materials are required for this course:

- **Book Pack (At OSU Bookstores)**
  - Project Management and Teamwork Karl Smith
  - Introduction to Graphics Communications for Engineers Gary Bertoline
  - Assignment Packet (contains all drawing assignments & necessary lab materials)

- **Floppy disks** - 3.5" High Density disks.
- **Mechanical pencil, eraser, 6" scale (inches and metric)**
- OPTIONAL: Course CD – available for download from WebCT. See in-class handout for more details.

Region 1 Computer Lab: The Region One Computer Lab in Hitchcock Hall, room 324, will be available for your use during the following hours:

Monday - Thursday	7:30 am - 10:00 pm
Friday	7:30 am -7:00 pm
Saturday	Closed
Sunday	1:00 pm - 9:00 pm

Online Evaluation Tools

WebCT: Online Course Management System
Address: http://class.osu.edu
Login: OSU Username & password
Troubleshooting: http://8help.ohio-state.edu/webcthelp.html or call 688-HELP (especially for passwords)

Uses

- Check your grades from the Course Tools page
- Check your syllabus & daily assignment list from the Homepage & View instructional team contact information from the Syllabus
- Post questions to the Discussion Board found on the Course Tools page to the instructional team and the class about homework, assignment due dates, lab problems, or policy issues. Other reminders and responses to journals will also be posted by the administrative team – keep your eyes open!!
- Access other evaluation tools: Course Sorcerer, Team Evaluations, and Purdue Visualization Test from the Course Tools page.
- Access all materials for the course including class presentations, procedures, and supplemental information including exam study guides, lab grading guidelines, helpful websites, and common questions and answers about the team projects from the Course Materials Pages.

Course Sorcerer: *Journal Entries & Course Evaluations*
Go to WebCT > Course Tools > Course Sorcerer
Login & Password: OSU standard information

What You Have To Do There:

Journal Entries
What: Respond to prompts about aspects of the class; includes multiple choice questions, short answer questions, and essay responses. All entries are confidential on the system
When: Biweekly, due on Fridays (check your daily assignment list for actual dates)
Grading: Counts for 1 percent of your final grade (VERY EASY 1%!)
Why: All entries will be read, summarized by the instructors and TA's and then shared collectively and anonymously with the whole class for the betterment of the program. In the past, responses have been used to assess the use of technology in the classroom, and measure student satisfaction of the instructional team, teaching styles, curriculum decisions, policies, and programs.
How: Log-in to Course Sorcerer and click on the hyperlinked entries to complete them. Don't forget: BE HONEST and BE CONSTRUCTIVE. If you have a complaint, please follow it with a suggestion for improvement or cite exactly where the problem is. Be clear and precise in your comments. Remember, grading is based solely upon completion NOT on content!

Course Evaluations
What: Lab Instructor, TA, and Final Course Evaluation
When: Last Week of the Quarter
Why: To have your say on how your experience was this quarter more so than just filling out a SEI form!
Note: There may be other evaluations and assessments that pop up on Course Sorcerer throughout the quarter. You will be notified of these as they arise.

Team Evaluations
Location: WebCT > Course Tools > Team Evaluations
Login & Password: OSU standard information

Mid-Quarter & Final Team Evaluations
You will rate each of your teammates in seven areas of cooperative skills during the fifth and the last week of the quarter. The mid-quarter evaluation will not count towards your grade but act as a tool to monitor how your group views your contributions. This is important because if you need to change your working habits you should do so quickly because the final team evaluation will bear weight on all team labs and team projects. Thus, you can lose a considerable number of points in the class if you are given a poor rating by your teammates.

Final Note: All scales for evaluations are from 1 (lowest) to 5 (highest). Please keep this in mind when completing Journal Entries, Course Evaluations, and Team Evaluations.

Engineering 181 Daily Assignment List
Sections 1, 3, 5 & 6

Week	Day	Date	Session	Assigned Work	Session Topic(s)	Assignments Due
1	T	7-Jan	Basics 1.1	Purdue Visualization Test (ONLINE); Freshman Attitudes Survey (ONLINE)	Introductions	
	R	9-Jan	Lab 1		Team Building Workshop	
	F	10-Jan	Basics 1.2		Intro to the Bridge Competition	Purdue Visualization Test (ONLINE); Freshman Attitudes Survey (ONLINE)
2	T	14-Jan	Basics 2	EXL 1 Journal Entry #1	Excel 1: Graphs & Scatter Plots	
	R	16-Jan	Lab 2	***Lab Memo 2 (IND)***	***Fundamental Concepts A (Beam Bending)***	
	F	17-Jan	Basics 3	EXL 2; E-Mail Discipline Choice; Read IGCE -Ch. 1, and 2 up to 2.4.1, pp. 1-33;	Excel 2: TrendLines & Functions	EXL 1 Journal Entry #1
3	T	21-Jan	Basics 4	DWG 1 & 2 IGCE -Ch. 2, pp. 33-40	Sketching & Isometric Pictorials	EXL 2, DWG 1
	R	23-Jan		***Lab Memo 3 (IND)***	***Fundamental Concepts B (Static/Dynamic Meas.)***	***Lab Memo 2***
	F	24-Jan	Basics 5	DWG 3 & 4 IGCE -Ch. 2, pp. 41-52	Isometric & Elliptical Projections	DWG 2
4	T	28-Jan	Basics 6	DWG 5 & 6 IGCE Ch. 2, s. 5, 6, & 8 Journal Entry #2	Multi-Drawing Skills	DWG 3 & 4
	R	30-Jan		***Lab Memo 4 (TEAM)***	***Fundamental Concepts C (Bridge Competition/ Reverse Engineering)***	***Lab Memo 3***
	F	31-Jan	Basics 7	DWG 7, 8, & 9.1	Coordinate Systems	DWG 5 & 6 Journal Entry #2
5	T	4-Feb	Basics 8	DWG 10 & 11	Missing Line	DWG 7, 8, & 9.1
	R	6-Feb		***Lab 6 Pre-Lab (TEAM)***	***Ice Cream Lab A (Energy Flow)***	***Lab Memo 4; Lab Memo 2 Rewrite***
	F	7-Feb	Basics 9		Oral Presentation Review & Midterm Review Session (Option: Introduction to PowerPoint)	DWG 10 & 11 RESEARCH MEETING MUST BE COMPLETED Midterm Team Evaluation

Week	Day	Date	Session	Assigned Work	Session Topic(s)	Assignments Due
6	T	11-Feb	Basics 10		MIDTERM EXAM	

	R	13-Feb		***Lab Report 5 & 6 (TEAM)*** ***Journal Entry #3***	***Ice Cream Lab B (Mass Balance)***	***Lab 6 Pre-Lab*** ***Outline of Oral Presentation***
	F	14-Feb	Basics 11	DWG 9.2, 12, 13	Missing View	Journal Entry #3
7	T	18-Feb	Basics 12	DWG 14, 15, & 15X	Intro to CAD	DWG 12, 13, 14, 15
	R	20-Feb		***Lab Memo 7 (IND)*** ***Lab 8 Pre-Lab (TEAM)***	***Camera Lab A (Shutter Mechanism)***	***Lab Report 5 & 6***
	F	21-Feb	Basics 13	DWG 16	Intro to 2D CAD	DWG 9.2, 15X
8	T	25-Feb	Basics 14	DWG 17 & 18	2D Detail Drawing	DWG 16, 17
	R	27-Feb		***Lab Memo 8 (TEAM)***	***Camera Lab B (Camera Circuitry)***	***Lab Memo 7*** ***Lab 8 Pre-Lab*** ***Draft of Oral Presentation Slides***
	F	28-Feb	Basics 15	DWG 19 & 20	3D Solid Modeling	DWG 18 Journal Entry #4
9	T	4-Mar	Basics 16	DWG 21	3D Solid Primitives	DWG 19
	R	5-Mar		***Lab Memo 9 (IND)***	***Camera Lab C (Manufacturing)***	
	F	6-Mar	Basics 17	DWG 22 & 23	Section Views	DWG 21
10	T	11-Mar	Basics 18	DWG 24, 24X, & 25	Creating Solids from 2D	DWG 20, 22, & 23
	R	13-Mar			***Oral Presentations***	***Final Presentation Slides*** ***Final Handout***
	F	14-Mar	Basics 19	Final Course Evaluation TA Evaluation, Lab Instructor Evaluation, Journal Entry #5; Final Team Evaluation	Team Building Workshop Part II Course Review	Lab Memo 9 DWG 24, 24X, 25 Journal Entry #5

Appendix 10 Draft Engineering Advising Sheet (General Model)

XXXXXXX Engineering (General Model)
2003-2004

Name_____SSN:_____Phone:_____

New to OSU: _____ email: _____@osu.edu

YEAR	AUTUMN	WINTER	SPRING
1	Math 151..... 5____ Chemistry 121..... 5____ Engineering 181..... 3____ Engineering 100 ……..1 ____	Math 152.....5____ Physics 131 .....5____ Engineering 183 .....3____	Math 153 .....5____ Physics 132.....5____ English 110.....5____
2	Math 254..... 5____		
3			
4			

LIBERAL EDUCATION (35 hrs)
English & Communication Skills (10 hrs)
English 110 (5)____
2nd Writing Course (5)____

Social Sciences (10 hrs selected from two of three groups)
a._____( )____
b._____( )____
c._____( )____

Arts & Humanities (10 hrs) (1 from each group)
a. Analysis of Texts and Works of Art
_____( )____
b. Historical Survey
_____( )____

Ethics & Professionalism (5 hrs)
_____( )____

Social Diversity
(May overlap with another GEC Category)
_____( )____

TECHNICAL ELECTIVES (XX hrs)
_____( )____
_____( )____
_____( )____
_____( )____
_____( )____
_____( )____
_____( )____
_____( )____
_____( )____

ADMISSION CONDITION
_____( )____
_____( )____
_____( )____

UNIVERSITY CAPSTONE (Waived–May be substituted for 5 hrs Social Science)

FOREIGN LANGUAGE (Waived-Certain Foreign Language courses may be substituted for other GEC courses – See your adviser)

Liberal Education	35
Required Engineering Core	41
Selected Engineering Core	XX
Major – Required	XX
Technical Electives	XX
TOTAL HOURS	1XX

The Ohio State University College of Engineering
General Education Curriculum (GEC) Courses*

ENGLISH & COMMUNICATION SKILLS (10 hrs)

A. First Course (5 hrs)
English 110

B. Second Course (5 hrs)
African-American and African Studies 367.02, 367.03, 367.04
Agricultural Communication 367
Arabic 367
Art Education 367.01, 367.02
Comparative Studies 367.01, 367.02, 367.03, 367.04
Economics 367.01, 367.02
Engineering 367
English 367.01, 367.02, 367.03, 367.04, 367.05, 367.06, 367.07
Family & Consumer Sciences Education 367
Journalism and Communication 367
Landscape Architecture 367
Modern Greek 367
Natural Resources 367
Philosophy 367
Physics 367
Political Science 367.01
Psychology 367.01, 367.02
Slavic Languages and Literatures 367
Sociology H367.01, 367.02, H367.03
Theater 367.01, 367.02
Women's Studies 367.01, 367.04
Yiddish 367

C. Third Course (Major Department)
Aeronautical and Astronautical Engineering 510.01, 510.02 AND 510.03 (all three must be taken)
Aviation 520
Chemical Engineering 521, 630, 760, 762, AND 764 (all five must be taken)
Civil Engineering 405, 406, 460, AND 619 (all four must be taken)
Computer and Information Science 560
Electrical Engineering 582
Engineering Physics – Physics 596
FAB Engineering 225, 695, 723, 724, AND 725 (all five must be taken)
Geodetic Science 625
Industrial and Systems Engineering 500, 608.01, AND 608.02 (all three must be taken)
Materials Science and Engineering 581.01, 581.02, 581.03, 695.01, AND 695.02, 695.03 (all six must be taken)
Mechanical Engineering 564, 570, AND 581 (all three must be taken)
Welding Engineering 690, 691, 692, AND MSE 581.02 (all four must be taken)

DIVERSITY EXPERIENCE (Must include one "diversity experience" course which may be taken from any GEC category. Underlined courses in all categories meet "diversity experience" requirements.)

African-American & African Studies 230
Biology 597
Family Resource Management 362
Geography 400
Geological Sciences H294
History 131, 132, 325
Linguistics 330
Psychology 375
Social Work 300
Sociology 306, 382, 435, 467, 608
Speech and Hearing 310
Women's Studies 370, 510, 520

SOCIAL SCIENCES (10 hrs selected from two of three groups)

A. Individuals and Groups
African-American & African Studies 101, 218
Anthropology 201, 202, 421.08
Human Development and Family Science 360, 361, 364
Journalism and Communication 101, 200, 431
Linguistics 202, 361, 365, 371
Political Science 201
Psychology 100, 371
Rural Sociology 378
Social Work 230
Sociology 210, 370, 380
Textiles and Clothing 372
Women's Studies 110

B. Organizations and Polities
Economics 201
Family Resource Management 243
Geography 460, 643
International Studies 201, 230, 231, 235, 245, 250
Natural Resources 400
Political Science 100, 101, 165, 210, 245
Rural Sociology 105
Sociology 101, 345

C. Human, Natural, & Economic Resources
Agricultural, Environmental, and Development Economics 200
Economics 110, 200
Family Resource Management 340
Geography 200, 240
International Studies 210, 215, 240
Political Science 145
Sociology 463, 466

ARTS & HUMANITIES (10 hrs)

A. Historical Survey (5 hrs)
African-American & African Studies 121-122
Economics 515-516
History 111-112, 121-122, 141-142, 151-152, 171-172, 181-182
Philosophy H111-H112

B. Analysis of Texts and Works of Art (5 hrs selected from categories 1., 2. or 3.)

1. Literature
African-American and African Studies 154, 251, 254, 271, 345, 452, 453, 551
Arabic 371, 372
Chinese 251, 501, 502, 503, 504
Classics 101, 102, 222
Comparative Studies 100, 201, 202.01, 202.02, 203, 204, 205, H240, 273, 301, 306, 308, 314
English 201, 202, 220, 260, 261, 262, 275, 280, 281, 290, 291
French 150, 151, 152
German 260.01, 260.02, 260.03, H263, 291, 292, 399
Hebrew 370, 372, 373, 374, 378
Italian 151, 152
Japanese 251, 252
Korean 251
Modern Greek 371
Near Eastern Languages & Cultures 271, 371, 372, 374
Persian 370, 371
Philosophy 215, 301, 302, 303, 304, 305, 306, 307
Russian 250
Scandinavian 222
Slavic Languages and Literatures 245
Spanish 320, 321, 520
Turkish 371, 372
Women's Studies 372
Yiddish 371, 399

2. Visual/Performing Arts
Architecture 271[1]
Art 170, 172, 201, 240
Art Education 160, 252
Comparative Studies 358
Dance 161, 200
East Asian Languages & Literatures 346
English 263
History of Art 210, 211, 212, 213, 216, 250, 260, 505, 515, 519, 520, 525, 530, 576
Italian 221
Landscape Architecture 201
Music 140, 141, 142, 150, 341, 345.01, 347[1], 349[1]
Philosophy 240, H242
Physics H455
Scandinavian 520
Spanish 322, 330
Theater 100, 161, H230, 271, 280[1]
Women's Studies 317

3. Cultures and Ideas
African-American and African Studies 342, 385.01
Anthropology 241
Arabic 241, 377
Arts and Sciences 494
Chinese 231, 232
Classics 224, 225, 226, 230, 240
Comparative Studies 234, 241, 242, 270, 272, 274, 294, 305, 335, 336, 339, 345, 377
East Asian Languages & Literatures 131, 341
English H167, 270,271, 276
German 275, 299
Hebrew 216, 241, 376
History 306, 330.01, 346
History of Art 240
Japanese 231
Jewish Studies 201
Korean 231
Linguistics 201, 311
Medieval and Renaissance Studies 210, 212, 213, 214, 215, 216, 217, 218, 219, 226
Modern Greek 241
Near Eastern Languages and Cultures 241, 244, 294, 311, 314, 341, 344, 351, 370
Persian 241
Philosophy 101, 130, 230, 270, 336
Portuguese 330
Religious Studies 270, 376
Romanian 235
Russian 135, 235
Slavic Languages and Literatures 130
Spanish 150, 151, 331
Turkish 241
Women's Studies 101
Yiddish 241

ETHICS & PROFESSIONALISM (5 hrs)

Tentative List
Philosophy 130, 130.0X, 367, 533
Comparative Studies 272, 367.02, 535, 597.01

UNIVERSITY CAPSTONE (Waived-May be substituted for 5 hrs Social Science)

FOREIGN LANGUAGE (Waived- Certain Foreign Language courses may be substituted for other GEC courses – See your adviser)

[1]Note that this is a three credit hour course and by itself does not meet the minimum credit-hour requirement for the VPA section.

22-OCT-03