

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

Office of the Provost and Vice Chancellor  
for Academic Affairs

Swanlund Administration Building  
601 East John Street  
Champaign, IL 61820



February 25, 2002

R. Linn Belford, Chair  
Senate Committee on Educational Policy  
Office of the Senate  
228 English Building, MC-461

Dear Professor Belford:

Enclosed are copies of a proposal from the Graduate College for the creation of a M.S. and Ph.D. program in Systems and Entrepreneurial Engineering.

This proposal has been approved by the Graduate College Executive Committee; it now requires Senate review.

Sincerely,

A handwritten signature in black ink, appearing to read 'Keith A. Marshall'.

Keith A. Marshall  
Assistant Provost

KAM/ml

c: C. Livingstone

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

EP.02.24

Graduate College

204 Coble Hall  
801 South Wright Street  
Champaign, IL 61820-6210



February 25, 2002

Keith Marshall  
Assistant Provost  
207 Swanlund  
MC-304

RECEIVED  
FEB 25 2002  
OFFICE of the PROVOST

Dear Keith:

On behalf of the Graduate College Executive Committee, I am pleased to inform you that the Graduate College has approved the proposal from the Department of General Engineering to establish the following new programs:

**M.S. and Ph.D. in Systems and Entrepreneurial Engineering**

If the new programs are approved, the existing M.S. in General Engineering will be phased out.

The proposal to establish these programs was considered at the January 28, 2002 meeting of the Program Subcommittee of the Graduate College Executive Committee. At that meeting, the proposal was unanimously approved, subject to some minor modifications, which the Department of General Engineering has made.

The revised proposal was unanimously approved by the Graduate College Executive Committee at its meeting on February 20, 2002. A copy of the proposal is enclosed.

It is our understanding that the proposed programs must be approved by the Senate as well as the Board of Trustees and Illinois Board of Higher Education. We believe that these will be strong programs and that their introduction is very timely.

Please let me know if you need additional information.

Sincerely,

A handwritten signature in cursive script, appearing to read 'Lamar Riley Murphy'.

Lamar Riley Murphy  
Associate Dean

Enclosure

c: Harry Cook  
David Daniel  
Nora Few  
Avijit Ghosh  
David Goldberg  
Mark Spong  
Deborah Thurston  
Richard Wheeler

## M.S. AND Ph.D. DEGREE PROGRAMS IN SYSTEMS AND ENTREPRENEURIAL ENGINEERING (SEE)

Department of General Engineering  
University of Illinois at Urbana-Champaign

### EXECUTIVE SUMMARY

Today's intensely competitive global economy places a high premium on engineers who can work in technologies at the intersection of engineering disciplines (*systems engineers*) and those who can blend their technical and business skills in an entrepreneurial way (*entrepreneurial engineers*). Many of the defining technologies of the 21<sup>st</sup> Century—mechatronics, information technology, nanotechnology, computational intelligence, and bioengineering to name a few—are being put into practice by broadly competent systems engineers. Moreover, entrepreneurial startups and well-established companies alike are looking for entrepreneurial engineers who augment their strong technical skills with the business insight, entrepreneurial vision, and leadership qualities needed to bring products successfully to the marketplace. Yet, traditional graduate engineering programs do not explicitly address the pressing need to combine engineering and entrepreneurship.

This document summarizes the salient characteristics of proposed M.S. and Ph.D. programs in *Systems and Entrepreneurial Engineering (SEE)* to help fill this need. In particular, the document summarizes the motivation for the program, the body of knowledge covered by SEE, its role within the UIUC mission, and the demand for the program by students, faculty, and employers. Henceforth, references to the SEE Ph.D. program are understood to encompass both the M.S. and Ph.D. programs.

#### MOTIVATION

**The role of the SEE program within the UIUC mission:** Economic development is now a key part of the UIUC mission. As the first new engineering Ph.D. program established following the University's enunciation of an active role in economic development, we expect the new SEE program to play an especially active role, directly and indirectly, in the economic livelihood of the State of Illinois.

**The importance of systems integration:** Three lessons of recent history are about the need for integration among engineering disciplines. The Cold War and the space program taught the lesson that technological feasibility in complex systems is driven by systems integration across disciplines of engineering. The end of the Cold War and the Japanese manufacturing revolution taught that commercial success is driven by systems integration across manufacturing engineering and marketing to provide quality to the customer. More recently, the information technology (IT) revolution taught the lesson that new technology is driven by systems integration across information systems, business systems, and science and engineering. All three generations of systems engineering place a premium on research and pedagogy at the interface of different disciplines of engineering, science, and business.

**The importance of engineering entrepreneurship:** Two lessons of recent history are about the need for engineers to be more entrepreneurial. Modern practice requires not only technological feasibility but also feasibility in the marketplace (*corporate entrepreneurship*). More recent times have taught that "new" technologies are being created by technology-based startups (*startup entrepreneurship*). Together, these two lessons place a premium on research and pedagogy at the interface of engineering and business.

**Challenges and opportunities:** These lessons have not gone unnoticed by our peers. For example, MIT formed an Engineering Systems Division (ESD) in 1998, and Stanford formed a Management Science and Engineering (MgtSE) Department in 1999. Other institutions such as Cornell, Georgia Tech and RPI have strong efforts under development in systems and engineering entrepreneurship. Yet, despite the recognition by others of the opportunity, it is not too late for UIUC to act and play an important leadership role in these fields. The proposed programs are UIUC's answer to the above challenge. Simply put, without such programs, the UIUC College of Engineering cannot compete against research programs already established or being established.

#### THE BODY OF KNOWLEDGE

The SEE Ph.D. program is highly integrative and therefore depends on well-established knowledge bases in all the major disciplines of both engineering and business. However, the program's claim to uniqueness is in its integration, and we envision two categories of knowledge created and taught by the program:

**Technology-technology knowledge (T2T).** Technology-technology research explicitly examines research problems at the crossroads of two or more technologies as is occurring in emerging engineering systems, such as mechatronics, MEMS, communications networks or robotics, and employs engineering technologies such as modeling, simulation, control, scheduling, and optimization to design new products.

**Business-technology knowledge (B2T).** Business-technology research explicitly examines problems at the crossroads of business and technology, such as those arising in product development, telecommunications pricing,

environmentally conscious manufacturing, incorporating customer preferences and social choices and using engineering technologies, such as utility theory, neural networks or genetic algorithms to model, analyze, and design innovation in organizations.

## RELATIONSHIP WITH OTHER UIUC PROGRAMS

The SEE program has a unique mission, but it is complementary to programs within the College of Engineering and the College of Commerce and Business Administration. Moreover, General Engineering, the home department of SEE, already has in place a strong program of education and research and is ready to take on the task without diluting existing programs.

**The only UIUC Ph.D. devoted to systems and business integration:** The SEE program is the only UIUC Ph.D. program devoted to the integration of engineering and business systems. It will focus on the integration of *different* technologies across both *existing* and *emerging* disciplines and the integration of business principles with one or more technical disciplines.

**A bridge to CCBA:** The SEE Ph.D. will serve as a bridge between the College of Engineering and the College of Commerce and Business Administration, providing a locus for funded research in such fields as technology management, six-sigma methods, e-commerce, supply chain management, product development and management, and the pedagogy of technology entrepreneurship.

**The ability to mount the program:** The General Engineering Department began the transition to a research-oriented department nearly 20 years ago and now has in place a strong program of research and scholarship. Throughout the 80s and the 90s, the department attracted and hired research-oriented faculty from peer institutions. Of the 20 graduate faculty, nearly half were hired after 1990, so that the focus of the Department as well as its self-image are now firmly established on the side of research. This year there are over 50 research contracts held by General Engineering faculty as single or co-PI involving a total funding level of more than \$8 M.

**Overlap with existing programs:** The term *Systems* is used in the College in such diverse areas as *computer systems, controls systems, communications systems, power systems, manufacturing systems, and micro electro-mechanical systems (MEMS)* that do not necessarily overlap one another apart from the name. The new SEE Ph.D. will add a new, complementary and interdisciplinary dimension to the more traditional engineering programs without usurping the important roles already occupied by these existing programs.

## DEMAND FOR THE PROGRAMS

Academic programs and the private sector will both seek graduates of the SEE program.

**Demand from Academia:** SEE Ph.D.s will be hired by (1) programs like ours, (2) related engineering programs, (3) traditional engineering departments, and (4) business schools. Although SEE is a relatively new concept, the actions of MIT, Stanford, UIUC and other schools should ensure growth. Related programs in systems, engineering management, and industrial and systems engineering will also move to hire SEE graduates. Traditional engineering departments may come to understand the need for faculty with more business background, and SEE will become one of several purveyors of choice. Finally, there is now a shortage of business faculty, and colleges of business may seek our graduates, especially for positions at the crossroads of business and technology.

**Demand from the private sector:** SEE Ph.D. graduates will fill important roles as (1) technology experts, (2) Product Planners, (3) R&D managers, (4) line managers of technology-intense divisions, (5) startup team members.

**Student demand:** Faculty in the SEE home department already advise Ph.D. students in other departments. The addition of the business side will open a new market. Roughly half of the undergraduate students within the SEE home department now declare a business-related concentration, and these students together with those at other institutions open new possibilities.

**SEE as a faculty magnet:** Creative individuals want to be involved in a growing and vibrant atmosphere. The SEE Ph.D. will supercharge a department that already has undergone a dramatic research makeover and it will help the University attract the best and the brightest faculty at the crossroads of disciplines in engineering and commerce.

## CONCLUSIONS

The SEE Ph.D. presents a unique opportunity for the University of Illinois to create a locus of excitement and serious research and scholarship at the (1) crossroads of engineering technologies and the (2) intersection of business and engineering. Students will come to the SEE program. Young faculty will be attracted to help shape the future of an important new discipline of engineering. Employers, both academic and private, will hire its Ph.D.s, and some of those Ph.D.s will also start new companies, some of them right here in Champaign-Urbana and many of them in Illinois. Taken together, the case for a Ph.D. in Systems and Entrepreneurial Engineering is a compelling one, but the first movers have taken the first steps. If UIUC wishes to play a leadership role, the window of opportunity will not remain open indefinitely, and the time to act is now.

**Proposal to the  
Senate Committee on Educational Policy  
From the College of Engineering  
Department of General Engineering  
For  
M.S. and Ph.D. Programs in Systems and Entrepreneurial Engineering**

**Sponsor:**

Harry Cook, Head  
Department of General Engineering  
117 Transportation Building  
104 S. Mathews Avenue  
Urbana, IL 61801  
333-2730

**Introduction:**

This proposal requests the establishment of M.S. and Ph.D. programs in Systems and Entrepreneurial Engineering within the Department of General Engineering. These degrees build on long-established BS and M.S. degree programs in General Engineering and on the mission of the Department to provide a design-oriented curriculum with an exposure to business principles. The General Engineering Department has long had strong ties to the College of Commerce and Business Administration through a joint MSGE/MBA program as well as through the Secondary Field requirements in the undergraduate curriculum. The Department recently reaffirmed its commitment to the business side of engineering through new faculty appointments and the development of new courses and funded research on the business side of engineering. These new efforts in business side research complement the already strong and growing research in interdisciplinary systems engineering so that the Department is well poised to offer the proposed graduate programs.

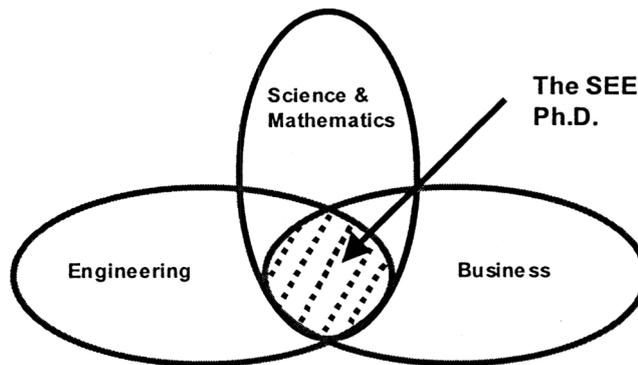
The proposed new programs are first and foremost engineering programs and, as such, bring a new dimension to the College of Engineering while simultaneously strengthening ties to the Business School. They are timely programs in today's intensely competitive global economy that places a high premium on engineers who can work in technologies at the intersection of engineering disciplines (*systems engineers*) and who can blend their technical and business skills in an entrepreneurial way (*entrepreneurial engineers*). Many of the defining technologies of the 21<sup>st</sup> Century—mechatronics, information technology, nanotechnology, computational intelligence, and bioengineering to name a few—are being put into practice by broadly competent systems engineers. Moreover, entrepreneurial startups and well-established companies alike are looking for entrepreneurial engineers who augment their strong technical skills with the business insight, entrepreneurial passion, and leadership qualities needed to bring products successfully to the marketplace. Yet, traditional graduate engineering programs do not explicitly address the pressing need to combine engineering and entrepreneurship. There is thus an unfulfilled demand for such programs and our peer institutions are moving rapidly to develop similar programs.

**Justification:**

The General Engineering Department is a multi-disciplinary, systems and design oriented Department with strong interest in the business side of engineering and strong ties to the Business School. The Department began the transition to a research-oriented department nearly 20 years ago and has in place a strong program of research and scholarship. Throughout the 80s and the 90s, the department attracted and hired research-oriented faculty from peer institutions. Of the 20 graduate faculty, nearly half were hired after 1990, so that the focus of the department as well as its self-image are now firmly established on the side of research. Since 1995 General Engineering faculty have served as PI or co-PI on over \$29M of research funding with over \$14M of that attributed directly to General Engineering faculty. This year there are over 50 research contracts held by General Engineering faculty as single or co-PI involving a total funding level of more than \$8M and over \$12M are contained in pending proposals (See Appendix F for details). These research contracts cover a wide variety of topics

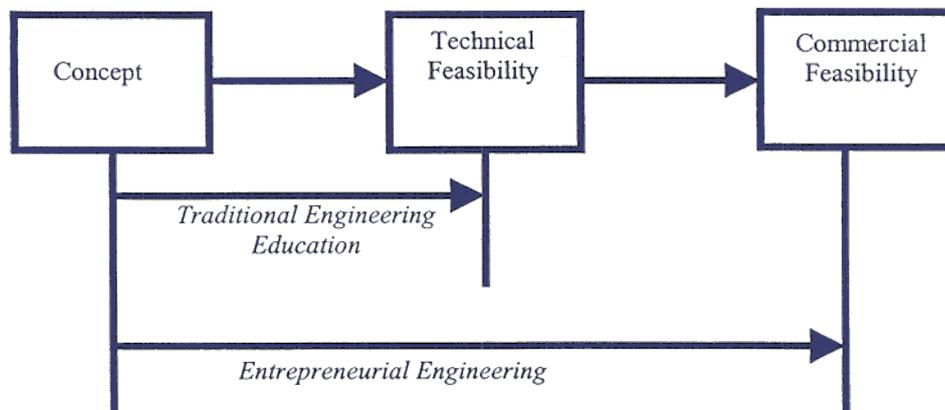
related both to systems engineering and entrepreneurial engineering. Both the Bachelor's Degree and Master's Degree programs in the Department attract students interested in systems engineering and students interested in combining engineering and business. Thus the Department of General Engineering is poised to fill the need for systems and entrepreneurial engineers at the Ph.D. level. The proposed Ph.D. program presents a unique opportunity for the University of Illinois to create a locus of excitement and serious research and scholarship at the (1) crossroads of engineering technologies and the (2) intersection of business and engineering to compete with similar programs elsewhere and to attract and retain the best quality students and faculty in these areas.

Our program will serve as a foundation for achieving intellectual and programmatic leadership in an emerging discipline that combines the technical skills with the business acumen needed for engineers to compete successfully in the global economy. The focus of the proposed program is in the cross-disciplinary research that connects traditional science and engineering problem areas with those in business and the environment (Figure 1).



**Figure 1 Intellectual Focus of the Systems and Entrepreneurial Engineering Program**

We see the challenge as enlarging the capability of engineering graduates and thereby the scope of their contributions. Current engineering programs focus on developing the traditional engineer who can take a new idea from its concept to a demonstration of technical feasibility. Today engineers must become highly proficient at extending their analyses to include commercial feasibility in its broadest sense (Figure 2). By this we mean the ability to accurately assess the impact of a new concept not just on its technical feasibility but its impact on the business bottom-line and the environment.



**Figure 2. Traditional versus Entrepreneurial Engineering**

A number of our peer institutions, most notably MIT and Stanford, have responded to this challenge with a reorganization of programs and units to increase the cross-disciplinary integration of business and engineering education. MIT formed an Engineering Systems Division (ESD) in 1998 (<http://esd.mit.edu/>) and Stanford formed a Management Science and Engineering (MgtSE) Department

in 1999 (<http://www.stanford.edu/dept/M.S.andE/>). The stated mission of MIT's ESD is "building new knowledge critical to industrial competitiveness and sustainable development" while training students to "solve complex physical design problems in the context in which the systems are initiated, designed, manufactured, marketed, and maintained. The ESD also acts as an umbrella organization for providing cross-disciplinary interactions between six graduate programs and four research centers. Stanford's MgtSE Department has 22 faculty whose mission is to develop the "knowledge, tools, and methods required to make decisions and shape policies, configure organizational structures, design engineering systems, and solve operational problems associated with the information-intensive, technology-based economy." The goal of the Department is to exploit the synergies of operations research, production operations, manufacturing, decision analysis, risk analysis, economics and finance, organization behavior, management and entrepreneurship.

The Operations Research and Industrial Engineering Department at Cornell University has developed a strategic plan to respond to this challenge by targeting three areas:

1. Business engineering education, financial service systems, financial engineering, and entrepreneurship
2. Information technology, information systems engineering, and statistical data mining as it applies to enterprise, business, and financial services
3. Systems engineering

See <http://www.orie.cornell.edu/~sid/ORPlanDec5.htm> for details.

The proposed M.S. and Ph.D. programs in Systems and Entrepreneurial Engineering (SEE) are our response to the above challenge. Simply put, without such a programs, the UIUC College of Engineering cannot compete against programs already established at MIT, Stanford, Cornell and soon elsewhere, for top faculty and graduate students whose research interests are in the business side of engineering. In its founding charter in 1921, the Department of General Engineering was instructed by the Board of Trustees to provide "fundamental engineering training with moderate emphasis on design and some stress on the business side of engineering and industry through sequences of courses in economics, money, and banking." In keeping with its charter, the Department has historically offered courses in engineering economics, engineering law, operations research, and decision-making in conjunction with its core engineering courses in design, controls, and structures, and has enabled hundreds of students to pursue fields of concentration in diverse business aspects of engineering.

During the last two years, the Department has reaffirmed its responsibility for the business side of engineering by developing and offering additional electives dealing with entrepreneurship, valuation and planning of new products, emotional intelligence, and team building. The concept for the newly created and rapidly growing Technical Entrepreneurship Program (TEP) headed by Professor Price originated in the Department. A minor in entrepreneurial engineering is being planned so that engineering students throughout the college who wish to augment their technical skills with entrepreneurial skills can readily do so. There are at least 250 students in this category throughout the College of Engineering as witnessed by the formation by the students, on their own initiative, of an Engineering Society for Business and Management.

Discussions are underway with the College of Commerce and Business Administration to offer a master's degree in engineering management. The reason for this is that a wide range of topics including marketing research, Six-Sigma methods, quality management, supply chain management, e-commerce, operations research, product planning, manufacturing planning, logistics, and entrepreneurship are common to the research and teaching interests of engineering and business faculty. The two colleges have already demonstrated that they can work together as evidenced by the successful joint development of the Technology and Management Program (TMP) approved as a Minor by the Faculty Senate in 2000 and by the Board of Trustees in 2001. The TMP was formed five years ago to prepare an ongoing, small but select, group of undergraduate engineering and business students with the skills to function well in a technical, interdisciplinary, team-based, industry environment.

The M.S. and Ph.D. programs in systems and entrepreneurial engineering will provide the means for the Department to recruit the very best faculty across disciplines. A common denominator will be their interest in wanting to work together in both research and teaching in fostering the integration of engineering and business at the systems level and in bringing substance and rigor to the emerging

discipline of entrepreneurial engineering. The proposed graduate programs draws upon the already strong program of research and scholarship in various aspects of engineering systems, engineering technologies, and information technologies, at the same time that it continues to develop a program in the business side of engineering. These existing strengths include traditional engineering fields of design, systems simulation, robotics, dynamics and control, genetic algorithms, micro-electromechanical systems, bioengineering, structural systems, nondestructive testing and evaluation, environmentally compliant engineering, communication networks, transportation systems, and management of large-scale engineering projects. Research underway in fields involving the business side of engineering includes entrepreneurship, decision theory, operations research, product management, and complex-system optimization. These research areas will evolve as the interests of the faculty change and new research areas will appear as new faculty come on board. Cooperation with faculty in other departments will continue to be sought in areas of common interest. Implementation of the proposed degree programs will accelerate the research activity in the Department and make the Department more competitive in recruiting the best new faculty hires.

Finally, the proposed degree programs significantly enlarge the existing research and scholarship effort within the Department. The productivity of the faculty within General Engineering is compromised by the fact that their home department does not have its own Ph.D. program. Research proposals from General Engineering faculty are not seen by certain reviewers as being as strong because the Department does not have its own Ph.D. program. The establishment of the proposed new programs will also allow faculty to recruit Ph.D. candidates directly to the Department whose interests are more closely aligned to the interests of the specific General Engineering faculty members. In addition, the qualifying exams can be tailored better to the student's planned area of study in General Engineering instead of being forced to take a less germane qualifying exam from another department. The Ph.D. program will provide the means for the Department to recruit the very best faculty and students across the disciplines represented by the Department.

#### **Summary of the degree requirements:**

We briefly outline the programs and degree requirements in this section. Complete details of the degree requirements are contained in Appendix A. The M.S. program forms Stage 1 of the Ph.D. program and serves to prepare students for Ph.D. level research or for industrial positions in systems and entrepreneurial engineering. Establishing the M.S. program at the same time as the Ph.D. program also serves students who choose not to continue their graduate studies to the Ph.D. level or who do not pass the Ph.D. qualifying examination. In these cases, credit earned toward the Ph.D. can be applied toward the M.S. degree.

The requirements for the M.S. and Ph.D. programs in Systems and Entrepreneurial Engineering follow the requirements outlined in the Graduate College Handbook.

**Stage 1: The Master's Degree.** The requirements of the Master of Science in Systems and Entrepreneurial Engineering are designed to facilitate interdisciplinary research by permitting the student to select from a variety of technical and business courses to meet individual career goals. Seven units of graduate level course work are required. Three units must be 400 level courses in General Engineering. Two of these must be 400 level courses in the systems area and one of these must be at the 400 level on the business side of engineering as outlined in Table 1 of Appendix A. Of the remaining four units, at least one must be in an engineering department.

In the **thesis option**, a written thesis is required in addition to the formal course work. The student selects seven (7) units of course work plus one (1) unit of thesis credit, GE 499, for a total of eight (8) units toward the degree.

In the **project option**, a project report is required in lieu of a thesis. The student selects seven (7) units of course work plus two (2) units of project design, GE 497, for a total of nine (9) units toward the degree.

The requirements for the proposed M.S. degree in Systems and Entrepreneurial Engineering differ from those of the existing M.S. degree in General Engineering only in the requirement that one 400 level course must be taken on the Business Side of Engineering. We are making this change together with the name change to align the focus of the M.S. degree more closely with that of the Department and with the proposed Ph.D. In this way students in the M.S. program will be better prepared for the

subsequent Ph.D. qualifying exam and for research with the faculty. As soon as the new programs are approved we will stop admitting students for the M.S. GE, which will subsequently be dropped after all the students enrolled in the program at the time pass through.

For students pursuing the Ph.D. degree in systems and entrepreneurial engineering, Stage 1 may also be satisfied by completing an M.S. degree in a related engineering or technical discipline from the University of Illinois or other accredited university. A non-technical M.S. or M.B.A. would normally not count toward the completion of Stage 1. Such students would be required to enroll in the Master of Science program in the Department and satisfy the requirements above in order to satisfy Stage 1 of the Ph.D. degree. Students who elect a non-thesis M.S. option in an engineering or other technical degree program must demonstrate their ability to carry out independent research. The determination will be made by the Department Graduate Committee on the basis of such factors as grades in academic work completed, registration in independent study courses, and letters of recommendation.

**Stage 2:** Admission to the Ph.D. candidacy. The Department requires the successful completion of a written qualifying examination for entrance to Stage 2 and admission to candidacy in the systems and entrepreneurial engineering Ph.D. program. Details of the requirements for the qualifying examination are given in Appendix A.

During Stage 2 the Department requires the completion of 8 units of course work in addition to those required for the M.S. degree. At least 4 units must be 400 level courses in the College of Engineering. A preliminary exam is taken upon completion of all the required course work or in the semester in which the final course work is taken, but not sooner. Successful completion of the preliminary exam fulfills the requirement for Stage 2. Details of the requirements for the preliminary exam are given in Appendix A.

**Stage 3:** The Ph.D. dissertation and defense. During Stage 3 the Ph.D. candidate conducts research culminating in an approved dissertation and final oral examination. Eight units of thesis credit, GE 499, are required to complete Stage 3 in addition to the dissertation.

In summary, the minimum requirements for the M.S. and Ph.D. degrees in systems and entrepreneurial engineering are:

**Stage 1**            8 units of graduate credit. Seven units of formal course work, one unit of thesis credit plus an M.S. thesis. Three of the seven units of course work must be 400 level courses in General Engineering, two in the systems area and one on the business side (see Appendix A). The M.S. degree requirements end at Stage 1. The Ph.D. degree requires completion of Stages 2 and 3 in addition to Stage 1. Students entering the Ph.D. program with an approved M.S. degree from outside the department are assumed to have satisfied Stage 1.

**Stage 2**            8 additional units of formal course work, at least 4 of which must 400 level engineering courses.

**Stage 3**            8 units of thesis research, GE 499.

24 units total

#### **Guidelines for Undergraduate Education:**

Not applicable

#### **Budgetary and Staff Implications:**

##### **a. Additional staff needed.**

The proposed graduate program in systems and entrepreneurial engineering can be carried out with the evolutionary changes and growth already planned as part of the Department's renewed commitment to the business side of engineering. Of the 20 graduate faculty in the Department, fourteen are primarily on the systems side of engineering, two are primarily on the business side of engineering, and four have interests that span both equally. In addition, two adjunct faculty (Professors Carnahan and

Vojak) have research interests spanning the systems and business sides of engineering. This mix of faculty is adequate to teach the current mix of graduate level courses required for the proposed programs. The Department is currently advertising for an additional faculty member whose research spans the business side of engineering. In addition, the faculty have agreed to commit to the business side of engineering the next slot that opens due to retirement.

The Graduate Committee of the Department is already in place, together with staff support, to administer the M.S. degree program in General Engineering. The faculty are already advising Ph.D. students from other engineering departments and supporting them financially through their own grants and contracts. Most of these students are housed in the Department even though their degrees are granted in other Departments. Therefore, office space, lab space, and staff support are already available to support the proposed programs. The Graduate Committee will assume the additional duties of administering the new M.S. and Ph.D. programs, including screening applicants for admission, arranging financial aid, administering the qualifying exams and the doctoral exams as required by the Graduate College. The Assistant to the Head is already experienced in preparing budgets for proposals and administering awards, including working with our own Grants and Contracts Office as well as external funding agencies. We anticipate that the new Ph.D. program and new faculty hires will result in a significant increase in revenue from grants and contracts that will more than offset any need for increased secretarial and staff support.

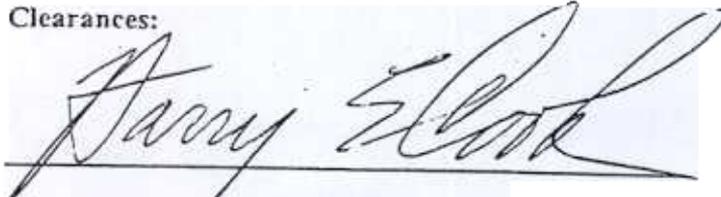
**b. Effect on course enrollments in other departments and explanations of discussions with representatives of those departments.**

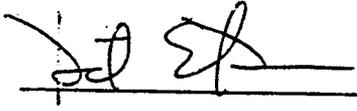
The effect will be small as the number of students is expected to grow slowly and modestly over the next several years. We have discussed the proposed programs with Dean Ghosh of the College of Commerce and Business Administration. As his attached letter indicates, the College of CBA welcomes the interaction with engineering and the additional enrollment in Business courses resulting from the proposed programs.

**c. Impact on the library, computer use, laboratory use, equipment, etc.**

The effect on the Engineering Library will be minimal. The Department of General Engineering already has research laboratories in place where faculty and graduate students from General Engineering and other departments already conduct funded research. No new laboratory space will be required to mount the new programs. Equipment needed for research projects will be funded by grants and contracts administered by the faculty.

Clearances:

  
Head, Department of General Engineering

  
Dean, College of Engineering

  
Dean, Graduate College

Chair, Senate Committee on Educational Policy

Statement for the Bulletin: See Appendix

Effective Date: January 1, 2003

# Appendix

## Graduate College Bulletin Entry

### GENERAL ENGINEERING

*Head of the Department:* H. E. Cook

*Correspondence and Information:* Graduate Programs, Department of General Engineering, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 South Mathews Avenue, Urbana, IL 61801; (217) 333-2730; E-mail: ge-grad@uiuc.edu  
URL: <http://www.ge.uiuc.edu/>

### GRADUATE DEGREE PROGRAMS

The Department of General Engineering offers graduate study leading to the Master of Science in General Engineering, Master of Science in Systems and Entrepreneurial Engineering and the Doctor of Philosophy in Systems and Entrepreneurial Engineering. The program consists of a core of required courses including a thesis with supplementary courses selected by the student together with an adviser.

The program offers an approach to systems engineering, engineering design, and entrepreneurial engineering that crosses disciplinary lines. Graduates of the program are prepared to enter professional engineering positions in industry, government, private practice, and academia. Graduate study and research may be pursued in the following fields: design systems, computer-aided design, optimization, manufacturing systems, nondestructive testing and evaluation, robotics, real-time decision making, reliability, entrepreneurial engineering, control, system dynamics and simulation, operations research/management science, and biomechanics.

### ADMISSION

Applicants who have completed degree requirements in an accredited engineering program or its equivalent are eligible to apply for admission. Qualifications for admission include a minimum grade point average of 3.0 (A = 4.0) for the last 60 hours of undergraduate work. All applicants must submit scores from the general test of the Graduate Record Examination (GRE). For students whose native language is not English, the Department requires a minimum paper-based TOEFL score of 600 (250 on the computer-based test).

### MASTER OF SCIENCE IN GENERAL ENGINEERING

The program consists of a core of required courses, a thesis or design project, and supplementary courses selected by the student and adviser. The minimum requirements for the degree are eight units of credit with a thesis, or nine units of credit with a project. Each candidate must also successfully complete at least seven units of graduate course work. Three of these must be departmental courses, two of which are required to be at the 400-level. The remaining four units are chosen by the student with the help of his or her adviser. In addition to these 7 units, either one unit of thesis credit or two units of project credit must be completed.

It is possible to pursue the M.S. in General Engineering and the MBA degree simultaneously. The total time required is less than that needed to obtain both degrees independently. A total of 21 units of credit is required, including four units of engineering course work and a project or thesis. The MBA requires eleven units of MBA core course work plus four units of MBA electives. Separate admission to both departments is required, although only one application is necessary.

### MASTER OF SCIENCE IN SYSTEMS AND ENTREPRENEURIAL ENGINEERING

Eight units of graduate level course work are required for the M.S. in Systems and Entrepreneurial Engineering. At least four of the eight units must be earned in residence. Three units must be 400 level courses in General Engineering (two technical and one business chosen from an approved list). One unit of thesis credit and a thesis are required. Of the remaining four units, at least one must be in an engineering department.

## **DOCTOR OF PHILOSOPHY IN SYSTEMS AND ENTREPRENEURIAL ENGINEERING**

The degree of doctor of philosophy is primarily a research degree. Candidates must demonstrate a capacity for independent research by preparing an original thesis, passing the departmental Ph.D. Qualifying Examination and be admitted to Ph.D. candidacy, and must pass the Preliminary and Final Examinations for the Ph.D. degree. Twenty-four units of credit beyond the bachelor's degree and a Ph.D. thesis are required. At least sixteen units of credit, which may include thesis credit, must be earned in residence.

The twenty-four units of credit may be divided into three stages of eight units each, consisting of eight units generally represented by an M.S. degree or equivalent, eight units of course work beyond the M.S. degree, and eight units of thesis work for the doctoral thesis. For students pursuing the Ph.D. degree in systems and entrepreneurial engineering, the first stage may be satisfied in several ways: 1) by completing the M.S. degree in systems and entrepreneurial engineering as above, 2) by completing the M.S. degree in the existing Master of Science program in General Engineering, or 3) by completing a Master of Science in a related engineering or technical discipline from the University of Illinois or other accredited university.

A student entering the Ph.D. program with a non-technical M.S. or MBA would be required to first enroll in one of the Master of Science Programs in the Department and satisfy the requirements therein. Students who elect a non-thesis M.S. option in an engineering or other technical degree program must demonstrate through previous work or through registration in independent study investigations that they are capable of carrying out independent research.

### **FINANCIAL AID**

Qualified students may apply for financial aid in the form of fellowships, teaching and research assistantships, and waivers of tuition and service fees.

Additional appendices are available  
for review in the Senate Office.