Five Year
Program Review

Industrial Engineering

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II. PROPOSED ACTIONS

The industrial engineering department proposes the following changes as a result of the program review process. The department met regularly this semester to thoroughly examine our program. This process was painful at times, but essential. As a faculty, we have a better understanding of how our courses interact and how loading should be distributed. Some changes in the course offerings semester will allow a more equitable distribution of courses and a broader exposure of students to the industrial engineering faculty. The proposed actions are as follows:

Eliminate WI-IE290: Problem Solving with Micro-Computers. This course provided essential micro-computer background to students entering the program, an introduction to industrial engineering and introductory engineering report writing skills. The need for teaching these micro-computer skills in our program has diminished, as students are now better adapted to use computers. The popularity and availability of powerful personal computers as well as, standardization and simplification of software have allowed virtually all students to have skills comparable to those taught in IE290. Students with no computer skills may take CSCI120 to learn fundamentals. The WI component of IE290 had been critical to meet general education requirements, but is no longer necessary, as IE490 is now designated as WI.

Add IE105, Introduction to Industrial Engineering. The industrial engineering program lacks an introductory course. The purpose of this offering is two fold: first provide advisors an option for students who may be interested in industrial engineering, but are unsure, and second to provide all students a broad understanding of what industrial engineering is and what industrial engineers might do upon graduation.

Students who are currently in the industrial engineering program who have completed or enroll in IE290 through spring, 2004 will be waived from the IE105 requirement.

Replace MATH390:Operations Research I and MATH391: Operations Research II with IE409: Operations research- Mathematical Programming and IE391: Operations Research – Probability Models respectively. The Math department has offered Operations Research I and II (MATH390 and MATH391) historically, to serve the requirements of the Industrial Engineering curriculum. Math has had faculty with the appropriate expertise and interest to teach these courses. In many universities, Operations Research is taught by industrial engineering faculty, and in light of faculty retirement in the Math department combined with curricula factors (also in Math), the Math department has offered to give responsibility of both MATH390 and MATH391 to the Industrial Engineering department. The topics are of primary interest and value to Industrial Engineering majors. Furthermore, Industrial Engineering has faculty with the appropriate expertise and interest to teach these courses. Math will no

longer be responsible for staffing two courses that primarily serve Industrial Engineering. The Math department has unanimously agreed to give responsibility of these two courses to industrial engineering, the Industrial Engineering department has agreed to accept both courses and both deans (Arts & Sciences and College of Business) support this change. The description and contents of the courses will remain intact, only the names and numbers will be changed. The proposed name changes reflect course content by being more descriptive, and eliminate the implied sequence of two independent courses. The proposed number change for MATH390 to IE409 reflects the level of content in the course and separates the course form IE391. Both courses are appropriate as third or fourth year courses.

Change the numbering of IE315: Engineering Economy to IE265: Engineering Economy. Changing the number from a three hundred level to a two hundred level better reflects the prerequisite skills required of the student. This course is currently available to second year students, many of who take this course in the second year. The course objectives (4-point sheet) will not change.

Eliminate the Industrial Engineering Minor. The industrial engineering minor was initially developed to give business majors an opportunity to take industrial engineering courses. The math requirements proved to be to high for many, and few students have shown interest. Furthermore, the prerequisites for the industrial engineering courses have changed, and make enrollment for students quite difficult. The industrial engineering department will work to develop a more dedicated degree (such as industrial management) in cooperation with other departments in the College of Business.

Change number of credits for IE450: Professional Experience. Professional experience in the form of an internship or job is a requirement for a bachelor's degree in industrial engineering. This course is a vehicle to show evidence on the student's transcript that this experience was completed and is billed in either the zone or as experiential credit ($30/hr). Many students will begin an internship and continue working for several semesters making variable credit for this course beneficial to students, as work experience (duration) can be reflected on the student's transcript. More critically, international students need to show evidence that work experience is a requirement of study in order to be compensated (F1 visa issues). The IE450 course has been used to fulfill this requirement. It is further proposed that there not be compensation associated with administering IE450, and that it not be considered part of a professor's teaching load. Administration will be a responsibility of the student's advisor. The department proposes that IE450 become a 1-credit course instead of a 3-credit course. Students will fulfill the IE450: Professional Experience requirement for a BSIE degree by completing at least one and up to six credit hours in IE450.

III. DESCRIPTION OF THE DEPARTMENT AND ITS PROGRAMS

The Industrial Engineering department resides within the College of Business, but predominately operates independently. The three full time faculty (and one faculty emeritus) teach IE designated courses and will complete a full teaching load by teaching courses in the MBA program (or College of Business) which reflect Industrial Engineering principles. Included in these courses are MBA505: Statistical Methods for Decision-Making, MBA670: Operations Management, MBAH706 Quality management in Health Care, and CSCI 120, Introduction to Computer Science.

The program had been administered by a Director, but was changed to a rotating Chair in 1998. Chair terms are three years (the current chair appointment is two years in order to stagger chair positions within the College of Business), chair appointments are made by the President of the University after recommendations from the Dean of the College of Business and the Vice President of Academic Affairs.

The BSIE program is offered to serve two student populations: (i) Traditional aged students who enter university right after high school, with little to no significant work experience and (ii) Non-traditional students who enter the program later in life. These students may have relevant work experience, completed studies at other institutions and full-time work commitments. As such, the IE department offers courses on a rotating basis between day and evening offerings (eg. Ergonomics is offered as a day class in Spring, 04, so it be offered as an evening/night course in Spring, 05). Each student is required to fulfill the general education requirements as defined in the catalog under which the student began course work. Beginning in fall, 2003, all IE students will fulfill the general education requirements as set forth under the new general education requirements. Students must complete (or receive credit, for transfers) each IE designated course offered. All IE courses are offered on campus as classroom courses; some are supplemented with blackboard.

PROGRAM DESCRIPTION WRITTEN FOR THE 2003-2005 CATALOG

> The Ambrose Institute (Department) of Industrial Engineering offers an accredited four- year program leading to a Bachelor of Science in Industrial Engineering (BSIE) degree. The Engineering Accreditation Board of Engineering and Technology (ABET) accredits the IE program. Course requirements, quality of instruction and the control of the curriculum meet or exceed nationally established requirements. This assures the student that their investment in education is valuable and protected.
>
> The Industrial Engineering program is designed to make a difference for its students. As a faculty, we focus on the student's learning needs to ensure their success and maximize their knowledge gains. The emphasis is on quality through accomplishment.

Integrated Design Experience
The program is based on the philosophy that the curriculum must be greater than the sum of individual courses. We educate students through a carefully engineered curriculum based on proven engineering design knowledge, a breadth of general education, modern computer technologies and the development of writing and thinking skills. Fundamental skills of model building; creativity, problem solving, and communication are integrated into the topic threads of graphics, design and writing. These threads link important concepts throughout the program and form an integrated network of experiences that are the engineering foundation of the program. The courses emphasize design through open-ended problem formulation and solutions that work for humankind in the best ways possible.

An integral part of this approach is the Senior Design Project in which a significant problem is identified and solved. This is done in a team environment working with a local organization that needs an engineering solution to an actual problem. Additionally, at least one semester's worth of work experience as an industrial engineer is required.

Educational Environment
As a teaching university, the quality of professor performance is measured by student learning. Professionally qualified faculty members, who recognize the importance of high academic and professional engineering standards, are dedicated to ensuring the success of students while at St. Ambrose and in the working world. Their focus is on preparing students for life. The faculty's concentration is on educating students in fundamentals and examining the most current theories and applications. Our method of instruction is based on an open, relaxed environment in which the students can flourish. Many students comment that they see the friendliness and approachability of the professors as a significant factor in helping them develop to their fullest potential.

SIGNIFICANT CHANGES TO THE PROGRAM SINCE THE LAST PROGRAM REVIEW

- Change the CSCI requirement from CSCI220: FORTRAN to CSCI195: C++,
- IE490 is a writing intensive course,
- Eliminate the requirement for ENGL 218,
- Change in program requirements: Offer PHYS306: Electronics, as an elective. Students now pick two of three courses (the other two courses are: ENGR312: Thermodynamics and ENGR303: Strength of Materials),
- Allow variable credit to be awarded for IE450: Professional Experience,
- IE Lab improvements,
- IE software and lab maintained by IT,

- Adoption of the University General Education Skills and Content requirements without exceptions,
- Take responsibility for MATH390 and MATH391 as IE409 and IE391, respectively.

Recent changes to the program include the adoption of university general education requirements with no exceptions. The industrial engineering lab is a requirement for accreditation and consists of 10 dedicated computers which have specialized software as required for the IE curriculum. In some cases, network licensure of this software is not available, appropriate or cost effective. Included in the IE lab are specialized equipment (a small milling machine, a five-axis programmable robot, programmable modeling equipment, electromyography equipment, time study equipment and miscellaneous tools and equipment) used for demonstration and laboratory exercises in courses. As such, the IE department uses this multi-purpose lab as a classroom for all of the IE designated courses. The Industrial Engineering department has entered into an agreement with Academic Computing to manage the computer hardware and software in the IE lab. The IE department manages the specialized equipment and computers not connected to the university network.

Other changes to the program since the last program review is the addition of an IE minor which opens our classes to students who are not seeking a BSIE, but are interested in studying IE related topics.

OUTSIDE CONSULTATIONS SINCE THE LAST PROGRAM REVIEW

We recently were re-accredited by ABET (in 2000) for a period of six years. The IE program was scrutinized by faculty during the accreditation process, and some changes/improvements to the curriculum and IE lab were made in response to the accreditors' observations. A significant change since the last program review is the restructuring of the Industrial Engineering Advisory Board. The former advisory board last met in Spring 1997 and consisted of representatives from manufacturing firms in the area along with a few friends of the University. The new board whose membership has developed over the last couple of years in response to faculty views of our place in the community as well as the new ABET Criteria under which we will be judged in the next accreditation. The new board has been instituted this fall, met Fall 2003 and has a broader range of membership to include representatives from manufacturing including several graduates of the SAU IE program, service and area community colleges. This membership better represents a cross section of businesses for which our graduates will work, and places from which our students will come. This board met to share the current state of the program, discuss recruitment ideas, discuss viability of a Certificate, and projects and cases for IE students.

Traditionally we have utilized feedback from our graduates and their employers in a somewhat informal fashion. The IE faculty feels that this new board will provide better insight to help us develop our curriculum and develop new programs to serve all our constituencies (students, employers, community and university

LONG RANGE PLANS FOR THE DEPARTMENT

Some items that we are working on and considering include:

- Develop stronger ties to the community through outreach programs to minority and under-represented populations (particularly SECME),
- Develop formal 2+2 programs with community colleges (EICC, BlackHawk),
- Developing relationships with high-schools and community colleges and St. Ambrose to increase interest in engineering,
- A program to bring graduates (from any institution) back to the classroom to learn industrial engineering principles,
- Opportunities for our students to study engineering in Europe in:
    i. St. Ambrose IE courses offered in Europe,
    ii. Exchange with institutions (Kaiserslautern, Davenport's sister city),
    iii. Internships in Europe through institutions (the Fachochschle in Kaiserslautern or companies),
- An Industrial Management degree in cooperation with Managerial Studies,
- A degree to combine Accounting with Industrial Engineering,
- A Masters degree in Engineering Management.

Stronger ties to the community

It has been said by many (area highs school counselors, community colleges, and ABET) that the industrial engineering program at St. Ambrose 'is a well kept secret that should be shared.' Although we have made attempts to publicize the program through advertising and occasional media stories (Paula Sands Live appearance of student who interned at NASA, interview on the Jim Fisher radio show for Industrial Engineering Month, short bit on KWQC for an "Ergonomic snow shovel" during a heavy snow), we are still a well kept secret. To reach out to the community, we began investigating building relationships between high schools, area business, community colleges and St. Ambrose. The plan is to build a relationship that gets a high school student into industry, then into college (be it community college, SAU, or into an engineering program elsewhere).

A national organization exists that ties the local school district to area companies and university. SECME is committed to bring more under-represented populations into science and engineering careers. The industrial engineering department has verbally committed to becoming a full university partner with the Davenport school system, ALCOA and the University of Iowa in this effort. This activity may bring students into our program, but it will help the industrial engineering department showcase the commitment to engineering and the community.

In addition to reaching out to high school students, the industrial engineering department has built a strong, positive relationship with Genesis Health Systems

over the past six plus years. The senior design seminar (IE490) projects are conducted in cooperation with the hospital. This has led to many innovative solutions to complex problems (a recent semester project in was fully implemented at a cost of $25,000 to the hospital and yielded benefits in excess of $150,000 in the first year. See article). The Chief Operating Officer has recognized the strength of our students and a "necessity" for continued projects (note file: genesis Letter).

Develop Formal 2+2 Programs

An enrollment study provided a measure of department effectiveness in reaching both traditional, high school students and non-traditional, transfer students. The results of this study reflect a significant jump in traditional student growth and opportunities to recruit transfer students (Appendix). As the number of undergraduate students increases (first year students) there is a higher demand for the early, general education courses. These often fill quickly. Development and marketing of 2+2 agreements with the community colleges will bring students directly into the industrial engineering curriculum with minimal strain on the overly strained general education courses. This will better utilize resources, as there are currently seats available in industrial engineering and the supporting science, engineering and math courses. Speaking with representatives from the community colleges further supports the need for such articulation agreements.

Develop Relationships With High Schools and Community Colleges

Through relationships with the area schools, we can better discuss our program with teachers and students to develop interest in St. Ambrose industrial engineering. Teaching modules of courses, conducting demonstrations and meeting with the appropriate clubs and groups are ways to educate the community about our program.

Program

Several people have inquired about taking industrial engineering classes but not pursuing a full degree. A certificate will provide these individuals with an opportunity to learn industrial engineering concepts most appropriate for their goals and receive transcript documentation of completion. A certificate for individuals with a Bachelor's degree may include MBA course work, and may also encourage these individuals to purse an MBA at St. Ambrose. A second certificate may be developed for individuals who do not have a Bachelor's degree, and include less a less quantitative group of courses. Both certificates would bring students into the classroom to share their unique perspectives.

Study Abroad Opportunities

The adoption of the new general education requirements includes coursework in foreign language. This requirement is strength of the industrial engineering program, and differentiates us from many other industrial engineering curriculum. A study abroad or work abroad program can then apply this language knowledge.

An international experience will further prepare the student for employment in an increasingly international workplace.

Industrial Management Degree

The idea of industrial management is to provide a middle ground curriculum for students interested in engineering, but with career goals in management. The new degree would require a higher level of mathematics than a management degree (through calculus II) and calculus based probability and statistics. Where possible, industrial engineering courses will be substituted for comparable management courses. Discussions with the Chair of managerial studies and the Dean of the College of Business have expressed initial support for this type of degree. The resultant degree would be much more quantitative than those existing in management currently.

Accounting and Engineering Degree

This idea is similar to industrial management but in cooperation with accounting. Many accountants will take jobs with either direct or indirect interaction with manufacturing and industry. Several industrial engineering courses may be appropriate for these individuals, to provide a better understanding of manufacturing. Several individuals have expressed an interest in such a degree program. As accountants need 150 hours of study to sit for the CPA exam, an industrial engineering component of their education may be appropriate.

Master's Degree in Industrial Management

A master's degree in industrial management is an alternative to an MBA. This degree would be more quantitative and include several industrial engineering courses in addition to a management perspective. This type of program has been successfully implemented in on-line as well as in-class formats. Such a program could be developed at St. Ambrose through the industrial engineering department or directly under the College of Business. Courses would be taught on-line or in the ACCEL format and serve area students who may not want an MBA, but are interested in graduate studies. Such a program would require additional resources, primarily, a full time director/administrator. The industrial engineering courses could be developed through modifying the current industrial engineering offerings and teaching them at ACCEL, on-line or a hybrid of both. Courses would be listed independently of the undergraduate courses; carry different numbers and not be substituted for an undergraduate course. One model of such a program offers courses as 2-credit hours, rather than three. This improves scheduling of the evening offerings. Adjunct faculty may also be employed to teach either in the ACCEL classrooms or the on-line offerings.

IV. ASSESSMENT OF THE DEPARTMENT AND ITS PROGRAMS

A. DEPARTMENTAL MAJOR ASSESSMENT PLAN

1) DEPARTMENTAL MISSION STATEMENT

The mission of the St. Ambrose Industrial Engineering program is to develop graduates who possess a strong fundamental knowledge of engineering and the world. Students will design and communicate practical solutions and alternatives to real problems that consider efficiency, economics, technology, and human welfare.

2) LEARNING OBJECTIVES

1. To learn the basic content knowledge of the industrial engineering discipline and learn principles and applications of basic sciences, engineering topics, and learn to communicate his/her knowledge of the discipline effectively.

2. To apply theory learned in the classroom to practical problems via exposure to the professional environment and interact with practicing engineers and professionals.

3. To receive a strong foundation in the humanities, arts and social sciences, philosophy, and foreign language, which will be applicable to the social and ethical responsibilities of practicing engineers in a diverse environment.

4. To integrate design throughout the curriculum providing the student with opportunity to develop and exercise: problem identification and solving, analytical skills, creativity, team skills, communication (oral and written) and decision-making.

5. To assure that the program's student experiences are current with regard to the needs of employers of industrial engineers in the manufacturing and service industries.

3) METHODS OF ASSESSMENT

Department faculty will assess the major primarily in department meetings, which occur no less than once each semester. Discussions revolve around each faculty member’s perspective, which is derived from experiences in the classroom, student comments, analysis of other industrial engineering programs, industry and current literature. Student needs are tempered by faculty knowledge and experience. Currently the industrial engineering department is developing a series of surveys to formally document student and alumni input. Surveys will also be developed, which will document area industry input.

Assessment of the individual learning objectives is primarily accomplished by the teaching professor, and disseminated to the department through department meetings and common faculty-faculty interaction and is addressed as follows:

1. To learn the basic content knowledge of the industrial engineering discipline and learn principles and applications of basic sciences, engineering topics, and learn to communicate his/her knowledge of the discipline effectively.

Outcome: Industrial Engineering curriculum content is consistent with the basic needs of graduates entering an industrial engineering career.

Assessment: Faculty reviews the curriculum content with reference to ABET requirements, IE Advisory Board comments, review of professional literature and curriculum at other institutions.

Outcome: Students will have learned basic science principles by satisfactorily completing the required basic science courses specified in the industrial engineering curriculum.

Assessment: Students must show satisfactory progress in each course by successful completion of examinations, papers, homework, assigned projects and class participation. The student's advisor examines student's grade patterns.

Outcome: Students will have learned basic industrial engineering principles by satisfactorily completing the required engineering topics courses specified in the industrial engineering curriculum.

Assessment: Students must show satisfactory progress in each course by successful completion of examinations, papers, homework, laboratory and design projects and class participation. The student's advisor examines student's grade patterns.

Outcome: Students will have learned basic communication skills by satisfactorily completing writing and speech courses.

Assessment: Students must show satisfactory progress in designated writing courses (ENGL 101 and the WI-designated courses) and a speech course.

Outcome: Students will have learned and applied industrial engineering knowledge in those courses, which contain engineering design experiences, particularly senior design seminar (IE490).

Assessment: Students must show satisfactory progress in the senior design seminar (IE490) while applying industrial engineering principles as needed to complete the assigned major design project. Student performance will be examined and evaluated by the industrial engineering faculty with input from the host company.

2. To apply theory learned in the classroom to practical problems via exposure to the professional environment and interact with practicing engineers and professionals.

Outcome: Students will have had the practical experience, which exercised the industrial engineering principles and practices in the classroom.

Assessment: The student in writing will report professional experience. Faculty reviews the experience as well as other practical experiences received as part of class exercises and in particular, the senior design project.

Outcome: Students will find employment in an area utilizing industrial engineering skills.

Assessment: At least 75% of industrial engineering graduates will receive a job offer or be employed. Data generated from the career development center and faculty input will be utilized.

3. To receive a strong foundation in the humanities, arts and social sciences, philosophy, and foreign language, which will be applicable to the social and ethical responsibilities of practicing engineers in a diverse environment.

Outcome: Students will have developed, through the general education component of the curriculum, a broad awareness of human cultures and societal relationships, which will support both the job related and social responsibilities of a practicing industrial engineer.

Assessment: Students must satisfactorily complete the general education requirements including one ethics course (Phil 207 or Phil 305).

4. To integrate design throughout the curriculum providing the student with opportunity to develop and exercise: problem identification and solving, analytical skills, creativity, team skills, communication (oral and written) and decision-making

Outcome: Students will have learned principles of design through multiple modes of teaching and different applications.

Assessment: Students must satisfactorily complete engineering courses, which contain requirements for the student to develop a unique design. Faculty will

evaluate homework, laboratory exercises and/or project work in the industrial engineering curriculum.

Outcome: Students will have learned and applied principles of problem identification, problem solving, team skills, communication and decision-making.

Assessment: Students must show satisfactory progress in design courses particularly the senior design seminar (IE490) where students must identify a previously unknown problem based on interactions with professionals, resultant data and analysis, conducting steering committee meetings, presenting results (both intermediate and final), while applying industrial engineering principles as needed to complete the assigned major design project. Student performance will be examined and evaluated by the industrial engineering faculty with input from the host company.

Outcome: Students will have learned effective communication of the discipline both written and oral.

Assessment: Students must show satisfactory progress written communication through report writing, and presentation both within the class (to peers) and outside of class (to professionals) in senior design seminar. Faculty will evaluate formal reports reflecting method, creative thinking, data analysis, and decision-making skills in design courses. Students are encouraged to present unique engineering work in journals and present work at local, national and international conferences.

5. To assure that the program's student experiences are current with regard to the needs of employers of industrial engineers in the manufacturing and service industries.

Outcome: Students will have confidence that the academic experience prepared them for their career.

Assessment: Faculty review of student performance in the senior design seminar and the documentation of professional experience.

Outcome: Students will believe they compare favorably with graduates from other industrial engineering programs.

Assessment: Data derived from employers, ABET accreditation, perceptions of graduates working in industrial engineering, comments from the advisory board.

Relationship To ABET Criteria

As part of ABET2000 criteria, each engineering program must demonstrate that their graduates have the following outcomes:

A. An ability to apply knowledge of mathematics, science, and engineering
B. An ability to design and conduct experiments, as well as to analyze and interpret data
C. An ability to design a system, component, or process to meet desired needs
D. An ability to function on multi-disciplinary teams
E. An ability to identify, formulate, and solve engineering problems
F. An understanding of professional and ethical responsibility
G. An ability to communicate effectively
H. 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
K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
L. An ability to design, develop, implement and improve integrated systems that include people, materials, information, equipment and energy

Industrial engineering learning objectives (1-5) mapped to ABET Criterion 3 (A-L)

	A	B	C	D	E	F	G	H	I	J	K	L
1	X	-	-	-	X	-	X	-	-	-	-	-
2	X	X	-	X	-	X	X	-	-	X	X	X
3	-	-	-	-	-	X	X	X	X	-	-	-
4	X	X	X	X	X	X	X	-	-	-	X	X
5	-	-	-	-	-	-	-	X	X	X	X	X

Matrix A (refer to Excel Spreadsheet file: Program Review Matrix) shows IE curriculum mapped to the Industrial engineering learning objectives (1-5) and to the ABET criterion (A-L).

4) DOCUMENTATION OF STUDENT LEARNING IN MAJOR

Currently, the teaching professor assesses learning as described in the "Program Review Worksheet." A number of students have demonstrated exceptional ability in their studies in the program. Many students have collaborated with faculty and each other to produce professional quality work as represented by the following list of student publications and presentations at national and international conferences. (senior design seminar projects, and work in other courses):

- Johnson, I. & Zorg, R (2004). Crutch Modification for Comfort and Functionality, *7th Annual Applied Ergonomics Conference,* Orlando, FL.

- Miron, F., White, J. (2003). History and Physical Documentation for Surgery Process, Journal of Industrial Engineering Design: in press.
- Campbell, C., Godoy, K. (2002). Employee strains and sprains at Genesis Medical Center, Journal of Industrial Engineering Design: vol. IV, no.3.
- Menke, J., Cotton, S., Brown, M. (2000). Improvement of hospital pharmaceutical delivery system, Journal of Industrial Engineering Design: vol. III, no 3.
- Ghandour, K., Kitchen, A., Lovejoy, S. (1999). Hospital linen management and control, Journal of Industrial Engineering Design: vol. III, no. 1.
- Gooch, K., Harmsen, D., Houston, S. (1998). Analysis and improvement of the painting operation at a pump company, Journal of Industrial Engineering Design: vol. II, no. 3.
- Prisk, W. (1998). Capacity/utilization reporting for U.S. Army maintenance depots, Journal of Industrial Engineering Design: vol. II no. 1.
- Gindl, M., Carrol, K., Carey, B.(1997). Bar-coding system for a small manufacturing facility, Journal of Industrial Engineering Design: vol. I, no. 1.
- Prisk, W., Bahns, B., Byers, C., Opar, M.E. (1997). Foundry operation simulation, using simplification mapping. *Proceedings of the Second International Conference on Industrial Engineering Applications and Practice*, San Diego, California.
- Jacox, E., Kitchen, A., Brundies, M., Brown, M., Sebill, J., Strang, E., Opar, M.E. (1996). A framework for curbside waste disposal. *Proceedings of the First International Conference on Industrial Engineering Applications and Practice*, Houston, Texas.

The following assessment activities are currently in place or will be in place during the spring semester 2004:

1. Alumni surveys will be prepared, distributed and analyzed by the faculty and will be repeated annually.
2. The department will work with the Career Development Center and the survey of graduates to obtain the most complete information regarding alumni placement.
3. Grade patterns will be reviewed by faculty each semester.
4. Faculty will review professional experience documentation and senior design documentation each year.
5. The IE advisory board will meet once each year to discuss any new or updated curricular needs which may be considered.
6. Curriculum learning objectives, outcomes and assessment information will be reviewed by the faculty annually.
7. Major curriculum reviews will be completed no less frequent than every five years. The assessment plan will be included in these evaluations.

8. ABET curricular requirements will be reviewed for changes on a continuing basis by faculty.
9. Student portfolios will be defined, collected and stored in the IE store room.

5) USE OF ASSESSMENT INFORMATION TO IMPROVE EDUCATION

Course content and learning objectives will be adjusted as needed based on the results of faculty review of assessment information. If changes are to be undertaken, the industrial engineering department will seek approval by the Education Policies Committee prior to implementation.

Data is accessible by the department chair concerning student progress, including grades and assessment information.

Assessment information will be analyzed and documented for the purpose of providing evidence relative to the adequacy of the curriculum and suggesting appropriate revisions. Such documentation will become part of program reviews.

6) EVALUATION OF THE DEPARTMENT ASSESSMENT PLAN

The faculty will meet as a department every other year to (odd number years) to review the plan and consider modifications.

B. ASSESSMENT OF TEACHING AND LEARNING IN THE MAJOR

1) DATA WHICH ASSESSES STUDENT LEARNING OF DEPARTMENTAL OBJECTIVES

The department meets regularly to discuss curricular issues as a function of our ABET accreditation. Evidence of this collaboration and results of these efforts is summarized in a paper written by the department for the ASEE (American Society of Engineering Educators) conference (Hill, T., Jerz, R., Kanzaki, G., Opar, M.E. (1998). An integrated education for ABET 2000: Experiences from a small university. *Proceedings of the American Society of Engineering Educators Annual Conference and Exposition*, Seattle, Washington, note file: abet2000.pdf).

Furthermore, each industrial engineering course four-point worksheet includes assessment information as to how the professor who teaches each course assess student learning.

The information that led to changes in the curriculum was derived from interactions with current students, alumni, faculty outside the department, area businesses that employ our graduates and from department faculty interactions

with other programs. The program review process has both confirmed our perceived strength of the program and revealed opportunities for improvement (note Genesis Letter file).

The industrial engineering department has done a good job developing the curriculum with respect to ABET accreditation standards, and have relied on that accreditation to serve as assessment. The department has been effective in developing good assessment within courses, integrating courses through projects and topics, and providing students with a strong education in industrial engineering. The program review process has brought to light an inadequate job of assessing the program as a whole and from perspectives other than ABET. Industrial engineering does not have appropriate documentation, such as survey results. As ABET accreditation standards have changed, the department must focus on development and implementation of effective assessment tools. These will include alumni surveys, portfolio development and collection, annual meeting with the industrial engineering advisory board, and closer scrutiny of our students' work.

The industrial engineering faculty is committed to continue this process after the program review. It is essential for us to continually examine our program and have unequivocal evidence of assessment. Furthermore, it is essential that these revelations are acted upon in order to continue our accreditation through ABET.

2) THE PROGRAM IN TERMS OF REQUIREMENTS, SEQUENCING OF COURSES, AND PREREQUISITES

Program requirements have been examined in light of ABET requirements for industrial engineering programs. The department changed the engineering science requirement from PHYS306 plus two of three ENGR courses (ENGER312, ENGR310, ENGR303) to the requirement of two of three courses (ENGR312, ENGR303, PHYS306). The ENGR310 course was no longer being offered so it was eliminated. PHYS306 was reduced to an optional course, as the industrial engineering faculty determined the course was a necessity for an industrial engineer. This change reduced the total number of hours in the industrial engineering curriculum by three, making adoption of the new general education requirements without exception reasonable with respect to total program hours. With the addition of WI to IE 490 we were able to drop the program requirement for ENGL 218 Technical Writing.

The industrial engineering curriculum has been scrutinized with regard to sequencing and prerequisites. Each IE course is offered once per year due to the number of students in the program and the number of IE faculty. Physics, Engineering, and Math also offer courses, which support IE students once per year with few exceptions. As a result, the schedule and offering semester of

courses has taken into account prerequisites and minimizes conflicts (between those courses an IE student will need to take in order to graduate when expected). Prerequisites for courses were examined, and updated for the 2003-2005 university catalog, and were reevaluated for the program review. This led to an additional change (MATH301 as a prerequisite for IE350).

3) GENERAL EDUCATION ASSESSMENT OF TEACHING

1. ALL COURSES
   Matrix B (refer to Excel Spreadsheet file: Program review Matrix); IE courses mapped to General Education goals (p.22 of the "1995 Academic Assessment Plan").

2. DESIGNATED GENERAL EDUCATION COURSES
   None offered through IE.

APPENDIX

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Industrial Engineering Enrollment Study

Introduction

Enrollment in the industrial engineering program since the first ABET accreditation has been a concern for the St. Ambrose University administration as well as the department. The department understands the limited availability of resources and that the University has an obligation to examine the effective use of these resources on a continuing basis. This study analysis provides a snapshot of student enrollment in industrial engineering from 1993-1994, the first year of ABET accreditation to present, 2003.

There are two primary measures of program enrollment health: 1) Enrollment in industrial engineering courses, and 2) Enrollment of industrial engineering majors in all courses leading to a degree in industrial engineering (BSIE). A more detailed analysis of industrial engineering majors by registration status, as well as non-industrial engineering students enrolled in industrial engineering coursework has also been examined.

Results

The data shown in the Recent Data spreadsheet (refer to Excel Spreadsheet file: enrollment figures) indicates relatively stable, but decreasing numbers since Fall 1999. The current semester (Fall 2003) shows a significant increase in total credits taken by IE majors, which corresponds to a significant increase in the number of new freshmen and new transfer students. Although the total credits taken in IE courses appears to be consistent with prior years as shown in the Fall statistics spreadsheet (refer to Excel Spreadsheet file: enrollment figures), this number will increase as those new students meet prerequisites and begin to enroll in the IE courses. As a result, it is expected that the total credits taken in IE courses will remain consistent with earlier years until Fall 2005. In the near term (2 years) an important indicator of program health will be the number of new freshmen, new transfers and continuing students. After the number of students in the program equilibrates (the freshmen and transfers become juniors and seniors), the total IE course credits taken will be a more representative indicator of program health.

The number of total IE majors has been consistent, though low, prior to Fall 2003. The large increases in the number of new freshmen reflect the efforts of the admissions and the industrial engineering department to publicize the benefits of an industrial engineering degree to high school students. The relatively consistent, though low, number of new transfers points to opportunities to recruit at area community colleges for industrial engineering students.

Interesting observations from the data reveal a small number of non-IE majors enrolling in IE courses; the students' majors listed include: Finance, Free, Engineering, Physics, CIS, and Fine Arts. Most of this activity results from cross-listing IE courses with engineering, students who have not declared an IE major, but who will become IE majors, and Theater majors taking Engineering Graphics (IE110).

Conclusion

The enrollment figures reveal a program that has been stable, though at a low enrollment level. The recent data from fall 2003 shows that the strong recruitment efforts in high schools are beginning to show results. Continuing this recruitment effort in conjunction with admissions combined with more active efforts to recruit from the community colleges will result in further, significant increases in new freshmen and new transfer students. The total credits taken in IE courses should increase slightly in the academic year 2004-2005, but show a significant jump in academic year 2005-2006 as new students become able to take the upper level IE courses, which comprise over 80% of the industrial engineering curriculum. The total credits taken by IE majors will continue to increase as the number of IE majors increase.