**ASSESSMENT PLAN**
**SCHOOL OF INDUSTRIAL ENGINEERING AND MANAGEMENT**

**Version 2.0 – April 2002**

## BACKGROUND

Industrial Engineering and Management (IE&M) is one of several schools within the College of Engineering, Architecture, and Technology (CEAT). IE&M offers baccalaureate, masters, and doctoral programs. The baccalaureate program is fully accredited by ABET, the Engineering Accreditation Commission; Accreditation Board for Engineering and Technology, Inc.; 111 Market Place, Suite 1050; Baltimore, MD 21202 (telephone, 410-347-7700; http://www.abet.org). ABET allows for only undergraduate or graduate program accreditation. CEAT has chosen to pursue undergraduate accreditation.

IE&M's assessment plan encompasses objectives and outcomes for all degrees. Objectives include knowledge and skills that most graduates are expected to possess from one to five years out. They are closely linked to success in professional practice. Outcomes include knowledge and skills that all students are expected to possess on graduation day.

## PURPOSE

### Vision

The School of Industrial Engineering and Management's vision is to be internationally recognized by industry and academia for excellence in education, research, extension, and service.

### Mission

The School of Industrial Engineering and Management's mission is to discover, verify, integrate, and transfer knowledge and methodologies relating to enterprise design and management, information technology, and modeling and optimization for the benefit of students, research sponsors, and the technical community.

### Core Values

Faculty, students, and staff work together to build and maintain a learning/mentoring environment where

- Innovative practices are developed, tested, and validated.
- Knowledge and practices are shared.
- Each individual develops to his/her full potential.
- Professional ethics are practiced at all times.

### Technical Overview

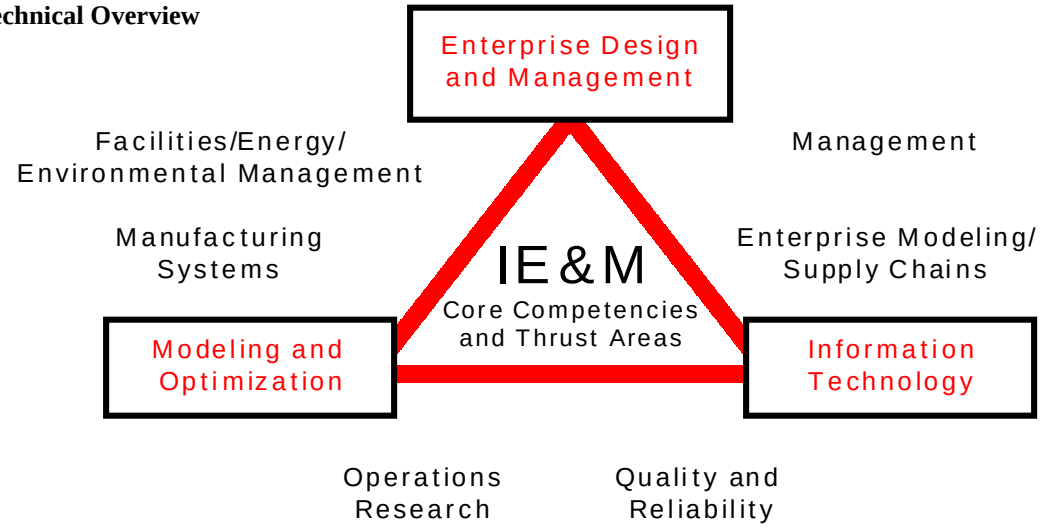


Figure 1 Technical overview depicting the core areas of competence within IE&M.

## OBJECTIVES AND OUTCOMES

### IE&M Educational Objectives

The educational program emphasizes the application of technologies and tools in the short term, and the ability to discover, acquire, and adapt new knowledge and skills in the long term, such that our graduates are prepared:

*i.* To define, analyze, and solve complex problems within and between enterprises.
*ii.* To discover, understand, and incorporate appropriate new technologies in the design and operation of enterprises.
*iii.* To lead/manage design, development, and improvement efforts that benefit customers, employees, and stakeholders.
*iv.* To function in culturally diverse teams, communicate in a professional manner, and uphold the ethical standards of the engineering profession.

### IE&M Baccalaureate Educational Outcomes

Graduating baccalaureate students possess an understanding of fundamental industrial engineering and management concepts, methodologies, and technologies as demonstrated by:

*a.* An ability to apply knowledge of mathematics, probability and statistics, science, engineering, and engineering economy.
*b.* An ability to design and conduct experiments involving risk and uncertainty, 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 culturally diverse, multi-disciplinary teams.
*e.* An ability to identify, formulate, and solve engineering problems involving physical, human, and economic parameters.
*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 the role of the human in enterprise activities.
*k.* An ability to use the techniques, skills, and modern engineering tools necessary for industrial engineering and management practice.

### IE&M Graduate Educational Outcomes

Graduating master's degree students will demonstrate:

*Depth*
*a.* Understanding of advanced concepts, methods, and technologies in an IE&M thrust area (please refer to Figure 1).
*Breadth*
*b.* Understanding of IE&M beyond a specific thrust area
*c.* Understanding the role of industrial engineering, management, and leadership in business and society.
*Comprehensive Thinking Skills*
*d.* Ability to identify, formulate, and creatively solve unstructured problems.
*e.* Ability to think at all six levels of Bloom's taxonomy (knowledge, comprehension, application, analysis, synthesis, and evaluation).
*Fundamentals*
*f.* Knowledge and skills required to apply fundamental IE concepts, methods, and technologies.
*g.* Sufficient knowledge and skills in math, basic science, and engineering science to successfully perform in their thrust area.
*h.* Understanding of professional and ethical responsibilities.
*i.* Ability to perform in culturally diverse, multi-disciplinary teams.
*Communication*
*j.* Ability to effectively communicate problem definitions, analysis, potential solutions, results, and recommendations to both technical and general audiences.

*Thesis Option* – In addition to the above, graduating students possess:
*k.* An understanding of research methodologies in terms of planning and executing a creative research program and communicating the results therefrom.

*Doctoral Level* – In addition to the above, graduating students possess:
*l.* A mastery of research methodologies in terms of planning and executing a creative research program and communicating the results therefrom.

**Educational Objectives and Outcomes Improvement Process**

Educational objectives are set and improved as depicted by the loop-like process in Figure 2. Here, the constituents are defined to be faculty, employers, alumni, and students. A series of boards/councils represent the constituents throughout this process, while the full faculty (all tenured and tenure track IE&M faculty) serve as gatekeepers for the mission, objectives, and outcomes. The updating process for mission, objectives, and outcomes works on an annual cycle.

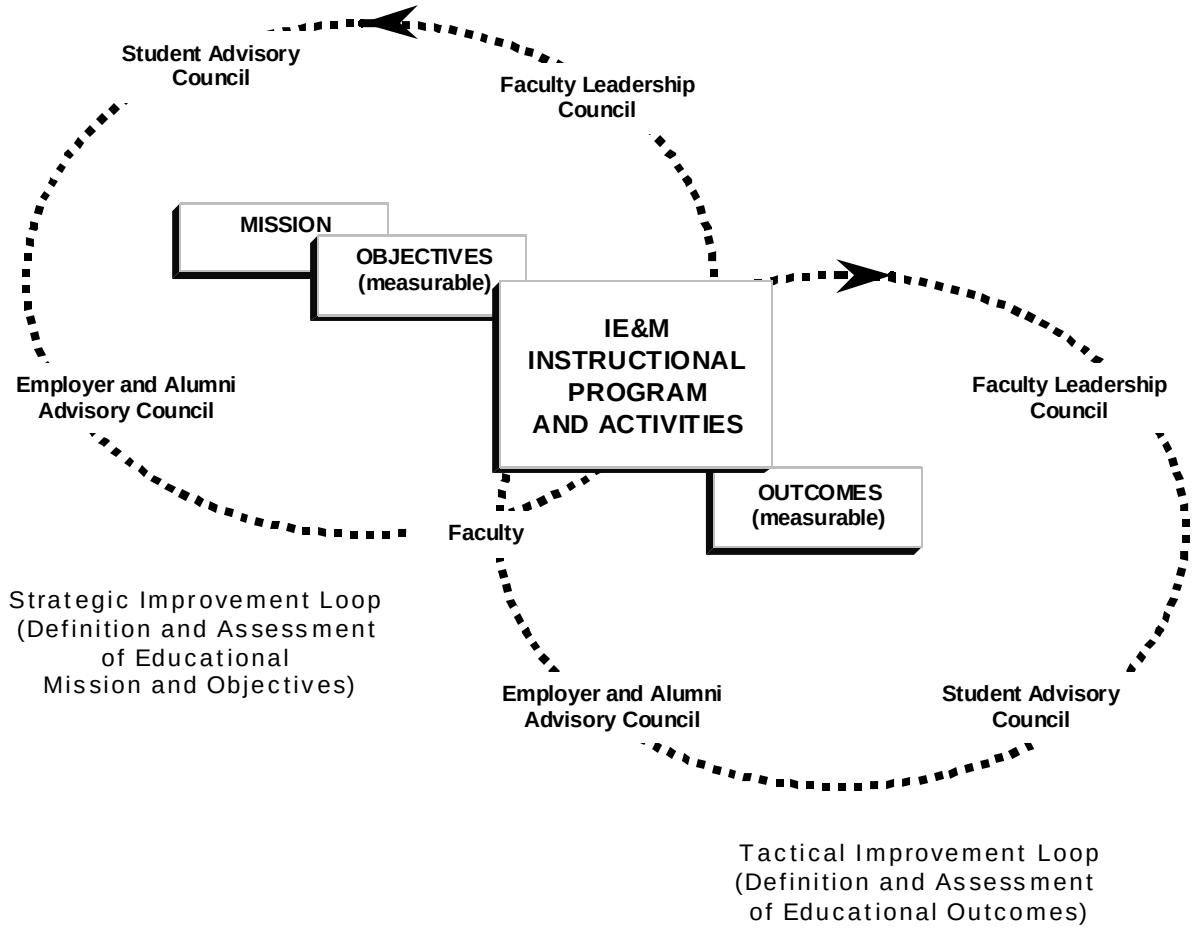


Figure 2 Objectives and outcomes improvement process depiction.

**Educational Objectives Assessment**

A variety of assessment tools (in addition to face to face discussions in the process cycles themselves) provide information and data for assessing how well IE&M accomplishes its objectives. Assessment methods include several tools: exit surveys and interviews, course portfolio evaluations, capstone project evaluations, summarized FE examination results, creative component results, thesis results, dissertation results, and alumni survey results. In addition, informal contact with alumni and recruiters is used to collect information that impacts decisions made in each process cycle. Annual or biannual assessment cycles are used (please refer to Figure 4). The assessment methods described below require participation from all groups of constituents: students, faculty, alumni, and employers.

**Baccalaureate Objectives Assessment Methods/Instruments**

| | Description | Targets |
|---|---|---|
| *Leading Indicators* | | |
| Exit surveys/interviews (Head, faculty, and IAB) | All students are given an extensive survey, where they provide quantitative and open-ended responses to questions regarding objectives, outcomes, courses, and program issues. Students are invited to discuss the survey or any other issues with the head. | 2.5/4.0 |
| Course portfolio evaluations* (Instructor, head, faculty and IAB) | Course outcomes, assignments, projects, examinations, labs (if applicable), and outcome evaluations are documented in the course portfolio. | Various |
| Capstone project evaluations (Student, faculty, client, and IAB) | Faculty and student peers assess and critique project work in progress as well as finished work. Finished work is also assessed by the client and by the IAB. | 2.5/4.0 |
| Fundamentals of engineering exam (Head, faculty, and IAB) | The results that are returned to IE&M are evaluated relative to the scoring in each category of the FE exam. | Nat. Avg. |
| Placement statistics (Head, faculty, and IAB) | IE&M utilizes placement statistics to the degree possible. Statistics are obtained from our placement office. | Various |
| *Lagging Indicators* | | |
| Alumni surveys -- One to two years out and three to five years out (Head, faculty, and IAB) | IE&M works with the University Assessment Office whereby our past graduates are surveyed at one to two years out. IE&M develops a large part of the survey instrument. | 2.5/4.0 |
| Web site survey/information collection** (Head, faculty, and IAB) | The IE&M Web site is designed to collect survey information and unsolicited input. | 2.5/4.0 |
| Informal feedback | IE&M faculty members keep in touch with many graduates regarding their career progress. This information is shared informally in our improvement cycles. | N/A |

*Portfolios consist of course-based materials, including objectives and outcomes and the assessment thereof. Portfolios are assembled each time the course is taught.

**A new Web site is under development and being tested, this instrument will be fully functional by Spring 2003.

**Masters and Doctoral Objectives Assessment Methods/Instruments**

| | Description | Targets |
|---|---|---|
| *Leading Indicators* | These leading indicators are used and described in Criterion 3. | |
| Exit surveys/interviews (Head, faculty, and IAB) | All students are given an extensive survey, where they provide quantitative and open-ended responses to questions regarding objectives, outcomes, courses, and program issues. Students are invited to discuss the survey or any other issues with the head. | 2.5/4.0 |
| Course portfolio evaluations* (Instructor, head, faculty and IAB) | Course outcomes, assignments, projects, examinations, labs (if applicable), and outcome evaluations are documented in the course portfolio. | Various |
| Creative component evaluations (Faculty committee) | Faculty advisors/committees assess the work done by masters students. | Various |
| Masters thesis proposal and defense (Faculty committee) | Faculty advisors/committees assess the work done by masters students. | Various |
| Doctoral proposal and defense (Faculty committee) | Faculty advisors/committees assess the work done by doctoral students. | Various |
| Placement statistics (Head, faculty, and IAB) | IE&M utilizes placement statistics to the degree possible. Statistics are obtained from our placement office. | Various |
| *Lagging Indicators* | | |
| Alumni surveys -- One to two years out and three to five years out (Head, faculty, and IAB) | IE&M works with the University Assessment Office whereby our past graduates are surveyed at one to two years out. IE&M develops a large part of the survey instrument. | 2.5/4.0 |
| Web site survey/information collection** (Head, faculty, and IAB) | The IE&M Web site is designed to collect survey information and unsolicited input. | 2.5/4.0 |
| Informal feedback | IE&M faculty members keep in touch with many graduates regarding their career progress. This information is shared informally in our improvement cycles. | N/A |

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**Educational Outcome Assessment**

The outcome-related metrics displayed below contain elements of evaluation from all groups of constituents: students, faculty, alumni, and employers.

**Baccalaureate Outcomes Assessment Methods/Instruments**

| Assessment Methods/Instruments | Description | Targets |
|---|---|---|
| *Direct Measures* | | |
| Exit surveys/interviews (Head, faculty, and IAB) | All students are given an extensive survey, where they provide quantitative and open-ended responses to questions regarding objectives, outcomes, courses, and program issues. Students are invited to discuss the survey or any other issues with the head. | 2.5/4.0 |
| Course portfolio evaluations* (Instructor, head, faculty and IAB) | Course outcomes, assignments, projects, examinations, labs (if applicable), and outcome evaluations are documented in the course portfolio. | Various |
| Capstone project evaluations (Student, faculty, client, and IAB) | Faculty and student peers assess and critique project work in progress as well as finished work. Finished work is also assessed by the client and by the IAB. | 2.5/4.0 |
| IE&M course outcome evaluations (Instructor, head, and faculty) | Each IEM course is evaluated by students, instructors, and the faculty with respect to assessing course outcomes. | 2.5/4.0 |
| University course evaluations (Instructor and head) | Each course is evaluated on a university-wide set of criteria dealing with delivery and content. | 2.5/4.0 |
| Student concern/complaint management (Student and head) | The head operates with an open door policy regarding student concerns and complaints. Concerns and complaints are addressed as they occur; general trends are used as feedback to the faculty and input into the improvement loops. | Various |
| Undergraduate student advisory council (Students and head) | A six-student advisory council selected by IIE, APM, and the Undergraduate Program Director serves to advise the head on issues and concerns regarding the IE&M program. Notes are taken describing the topics and activities of the group. | Various |
| Fundamentals of engineering exam (Head, faculty, and IAB) | The results that are returned to IE&M are evaluated relative to the scoring in each category of the FE exam. | Nat. Avg. |
| Web site survey/information collection** (Head, faculty, and IAB) | The IE&M Web site is designed to collect survey information and unsolicited input. | 2.5/4.0 |
| *Indirect Measures* | | |
| IIE, INFORMS, and APM membership participation | IE&M encourages all students to become IIE and/or INFORMS members and also encourages qualified students to become Alpha Pi Mu members. | 75% |
| Field trip participation | IE&M encourages students to participate in plant visits/field trips. | 100% |
| Placement Statistics | IE&M utilizes placement statistics to the degree possible. Statistics are obtained from our placement office. | Various |

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**A new Web site is under development and being tested, this instrument will be fully functional by Spring 2003.

**Masters and Doctoral Outcomes Assessment Methods/Instruments**

| Assessment Methods/Instruments | Description | Targets |
|---|---|---|
| *Direct Measures* | | |
| Exit surveys/interviews (Head, faculty, and IAB) | All students are given an extensive survey, where they provide quantitative and open-ended responses to questions regarding objectives, outcomes, courses, and program issues. Students are invited to discuss the survey or any other issues with the head. | 2.5/4.0 |
| Course portfolio evaluations* (Instructor, head, faculty and IAB) | Course outcomes, assignments, projects, examinations, labs (if applicable), and outcome evaluations are documented in the course portfolio. | Various |
| Creative component evaluations (Faculty committee) | Faculty advisors/committees assess the work done by masters students. | Various |
| Masters thesis proposal and defense (Faculty committee) | Faculty advisors/committees assess the work done by masters students. | Various |
| Doctoral proposal and defense (Faculty committee) | Faculty advisors/committees assess the work done by doctoral students. | Various |
| IE&M course outcome evaluations (Instructor, head, and faculty) | Each IEM course is evaluated by students, instructors, and the faculty with respect to assessing course outcomes. | 2.5/4.0 |
| University course evaluations (Instructor and head) | Each course is evaluated on a university-wide set of criteria dealing with delivery and content. | 2.5/4.0 |
| Student concern/complaint management (Student and head) | The head operates with an open door policy regarding student concerns and complaints. Concerns and complaints are addressed as they occur; general trends are used as feedback to the faculty and input into the improvement loops. | Various |
| Graduate student advisory council (Students and head) | A six-student advisory council selected by IIE, APM, and the Graduate Program Director serves to advise the head on issues and concerns regarding the IE&M program. Notes are taken describing the topics and activities of the group. | Various |
| Web site survey/information collection** (Head, faculty, and IAB) | The IE&M Web site is designed to collect survey information and unsolicited input. | 2.5/4.0 |
| *Indirect Measures* | | |
| IIE, INFORMS, and APM Membership Participation | IE&M encourages all graduate students to become IIE and/or INFORMS members and encourages qualified students to become Alpha Pi Mu members. | 75% |
| Placement Statistics | IE&M utilizes placement statistics to the degree possible. Statistics are obtained from our placement office. | Various |

*Portfolios consist of course-based materials, including objectives and outcomes and the assessment thereof. Portfolios are assembled each time the course is taught.

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**Educational Objectives and Outcome Assessment Instrument Descriptions**

**Surveys**
Surveys are tailored around the educational objectives and the specific program outcomes. The objective and outcome-related questions are scored on a quantitative scale. The surveys also contain several open-ended questions. These questions help us to understand student perceptions regarding perceived "strengths" and "weaknesses" in any part of the program from the first to the final year. They also allow us to collect ideas that students offer as to improvement within our program. These surveys are anonymous, however, every student is welcome to discuss the issues with the head.

**Portfolio Evaluation**
Course portfolios are available for IE&M constituents (faculty, alumni, and employers) to review. Instructors build and review the course portfolio during the term the course is offered. Faculty reviews take place in end-of-semester improvement meetings, while Industrial Advisory Board review takes place during IAB meetings. Reviews consist of open-ended discussions of the quantitative (compiled) results of the objectives and outcomes assessment with respect to the course objectives, outcomes, and content. Review summaries and results are fed into the course and curriculum improvement plans. Details on improvement management, including improvement plan lists are provided in Figure 4.

**Course Objective/Outcome Evaluations**
All IE&M courses are evaluated each term they are taught. Course objective/outcome evaluations are developed from the course objectives/outcomes stated in the course syllabus. Each course objective/outcome is represented in the course evaluation survey. Students provide a self-assessment of their abilities relative to the listed objectives/outcomes on a quantitative rating scale. The instructor reviews these results in conjunction with the stated course objectives and outcomes to formulate his/her perception of accomplishment. Although survey instruments are tailored to each course, the basic format includes: course number and title, section, instructor, date, outcomes (broken out by sub-criterion), ratings, comments, and instructions for reviewers. A template rating form is used to develop the survey contents to insure uniformity of scaling across IE&M. Results are quantified and are used for course improvement feedback before the course is offered again.

**University Course Evaluations**
Students evaluate courses at the end of each term. These evaluations are divided into two broad categories, instructor and course. The evaluation results are made available to the instructors and head once they are returned to the school by the administration. Information from these evaluations is used to impact course improvement.

**Fundamentals of Engineering Examination Results – Industrial Engineering** (National Council of Examiners for Engineering and Surveying)
IE&M students are encouraged to complete the FE examination and to pursue professional registration. The current general subject materials include chemistry, computers, dynamics, electrical circuits, engineering economy, ethics, fluid mechanics, material science, mathematics, mechanics of materials, statics, and thermodynamics. The discipline specific subject materials include industrial cost analysis, computer computations and modeling, engineering economics, engineering statistics, design of industrial experiments, facility design and location, information systems design, industrial management, manufacturing processes, manufacturing system design, material handling system design, math optimization and modeling, productivity measurement and management, production planning and scheduling, statistical quality control, total quality management, queuing theory and modeling, simulation, and work performance and methods.

**Creative Component, Thesis, and Dissertation Evaluation**
Each masters and doctoral student has a committee that guides him/her in course selection and professional development. Creative component work, thesis work, and dissertation work is evaluated by the student's committee. Each committee contains a minimum of three faculty members, chosen by the student. Committees and faculty advisors (the committee lead) provide professional development advice as well as assess the progress in professional development.

**COURSE/CURRICULUM REVIEW AND IMPROVEMENT PROCESS**

Curricular improvement, as depicted in Figure 3, occurs at several levels, the course/topical level and the curricular level. All course changes are addressed towards improvement/accomplishment of outcomes and objectives.

Each faculty member is responsible for the successful planning and delivery of his/her course. Each faculty member has the authority to do the same and improve the same. Course-level improvements are initiated by the faculty as a result of inputs received from any of a variety of sources as previously described. Course changes within the existing course description are typically discussed with the head and implemented in the next delivery cycle.

Curricular changes (such as course requirements and descriptions) are proposed by faculty members and/or constituents and reviewed/approved by the faculty. Course descriptions of a topical nature are proposed by faculty members or constituents and reviewed by faculty and constituents. Constituents involved in the reviewing process include the faculty, the IAB, and the student advisory councils. Implementation is expected in the next delivery cycle after the changes have been approved or as soon as university approval (if necessary) is obtained.

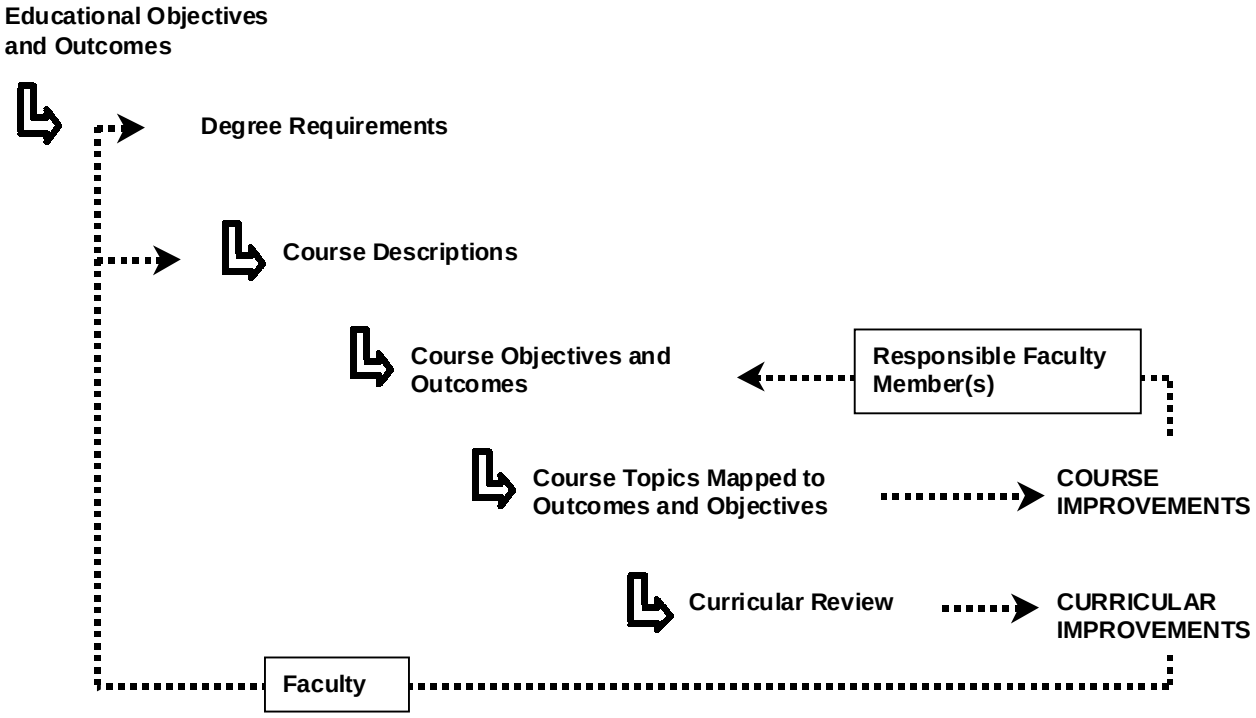


Figure 3 Curricular and course improvement cycles.

**IE&M Improvement Management Plan**

IE&M's approach to improvement requires a disciplined management plan and the implementation and maintenance thereof. The management plan and timetable are provided in Figure 4. Here, action and implementation items, primary responsibilities, and timing of the elements described in criteria approaches are summarized. The management plan is designed to provide course improvement by semesters and curriculum and process improvement on an annual basis. It involves all faculty members in IE&M. All improvements are managed from one of three lists: (1) the course improvement list, (2) the curriculum improvement list, or (3) the process improvement list. Hence, administration and control are straightforward and relatively simple.

General Management Plan

| Item | Responsibility | Timing: A S O N D J F M A M J J |
|---|---|---|
| Action | | |
| Topical mapping/ issue identification | Instructor | |
| Head and instructor review of issues | Head and instructor | |
| Roll up of issues | Head and instructor | |
| Assessment activity, data/information | Faculty and IAB | IAB IAB |
| Program review meeting* | Head/Faculty | |
| Strategic planning retreat* | Head/Faculty | |
| *Typically held the Wednesday after each term ends. | | |
| Implementation | | |
| Course improvement action list | Instructor | |
| Curriculum improvement action list | Head/Faculty | |
| EC 2000 process improvement action list | Head/Faculty | |

Figure 4 Management plan and timetable.