Standard Operating Procedure

Undergraduate Program Assessment and Control (UPAC)

Abstract

This Procedure establishes the policies, procedures and instruments to be used for defining, assessing, and maintaining the baccalaureate degree programs in Electrical Engineering (EE) and Computer Engineering (CpE). It identifies the constituencies, Educational Objectives, and Program Outcomes for each program, defines their mapping into the curriculum, and ABET accreditation criteria. It also specifies the structure and implementation of the program assessment processes including responsibilities, assessment instruments, reports, and schedules.
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1. **Purpose**

This Standard Operating Procedure (SOP) establishes the policies, procedures and instruments to be used for defining, assessing, and maintaining the baccalaureate degree programs in Electrical Engineering (EE) and Computer Engineering (CpE). Specifically, it:

1. Identifies the constituencies served by this department, and representative groups for each;
2. Defines the broad high-level *Educational Objectives* for each program,
3. Defines more specific, measurable *Program Outcomes* for each program,
4. Identifies the relationships between the Educational Objectives, Program Outcomes, curriculum, and ABET accreditation criteria [2],
5. Defines the structure and implementation of the program assessment processes including responsibilities, assessment instruments, reports, and schedules.

2. **Responsibilities**

1. **ECE Department Faculty**: has the final authority for oversight, maintenance, revision and approval of this SOP and all actions specified herein.

2. **Undergraduate Program Committee (UPC)**: has the authority and responsibility to execute this procedure on behalf of the ECE Department faculty. In addition, the UPC may, without prior faculty approval, implement minor editorial and/or cosmetic revisions that do not alter the intent of the document.

3. **ECE Assessment Coordinator (AC)**: serves as a member of the UPC, and executes other specific duties defined herein. Actions listed herein as the responsibility of the Assessment Coordinator (AC) may be delegated by the AC to another member of the UPC. However, ultimate responsibility remains with the AC.
3. Mission and Constituencies

3.1. Department Mission

The mission statement of the ECE department is; “To provide quality educational programs in electrical and computer engineering”. Given the importance of electrical and computer-based technology to the future, this is consistent with the MTU mission statement “We create the future”.

3.2. Constituencies

The department’s undergraduate programs serve three main constituencies: students, employers, and graduate schools, each of which has its own representative body or bodies.

3.2.1. Students

Our primary constituents are the students themselves, including current students, prospective students, and alumni. The primary representative body for students is the department’s Undergraduate Advisory Committee (UAC). In addition, there are several formal instruments for gathering student and alumni input, as detailed in Section 5. Finally, the department maintains an open-door policy, by which any student may informally express his/her concerns or opinions to the Department Chair or Associate Chairs.

3.2.2. Employers

As the primary employers of our graduates, commercial, industrial and governmental entities have a major stake in the quality and content of our program.

- For CpE program, employers include both primary computer manufacturers and other industries and agencies whose products, processes, or systems employ embedded and/or general-purpose computer systems.
- For the EE program, primary employers are engineering and business consulting firms, government agencies, and manufacturers of electrical and electronic and computer and office equipment, industrial machinery, and professional and scientific instrumentation. Other employers include transportation, communications, and utilities firms as well as computer and data processing services firms.

The ECE Department’s External Advisory Committee (EAC), the primary representative body for this constituency, comprises several successful engineers from leading companies and agencies. The EAC meets semi-annually, with several goals: to help assess the Department’s teaching, research, and service programs; to serve as a sounding board in the Department’s planning process; and to provide a front-line perspective on industrial applications of electrical and computer engineering.

3.2.3. Graduate Schools

The baccalaureate degree is the foundation upon which post-graduate education is built. The department is therefore mindful of its duty to provide graduates with the background, skills and perspective needed to pursue a career in research and education.

The primary representative body for graduate schools is the ECE Department Graduate Committee. Their role is to represent the needs and wants of graduate programs regarding the knowledge base and
abilities of our graduates. In addition, alumni assessment instruments include those alumni attending graduate schools.

4. Undergraduate Program Specifications

This section formally defines the *Educational Objectives* and *Program Outcomes* for the ECE department’s Baccalaureate degree programs. In addition, it specifies the mapping between the Objectives, Outcomes, and those activities and components tasked with achieving the Outcomes.

4.1. Definitions

The baccalaureate programs are defined in terms of *Educational Objectives*, *Program Outcomes*, and the *Academic Curriculum*. This subsection defines these terms and their relationships to each other. Subsections 4.2 and 4.3 then specify these properties for the CpE and EE degrees, respectively.

- **Educational Objectives** are broad, general statements of what graduates are expected to accomplish during the first few years after graduation, expressed in layman-friendly terms. Objectives focus on “what” is expected, not on “how” they are accomplished, or what skill sets are needed to enable those accomplishments. Those topics are the domain of *Program Outcomes*.

- **Program Outcomes** are detailed, measurable statements derived from the Educational Objectives, which define the knowledge, skills, and attributes that equip our graduates to achieve the Educational Objectives. Outcomes are generally stated in the form of what students “shall have demonstrated...” by the time of graduation.

- **Academic Curriculum**, combined with extracurricular activities, constitutes the formal pedagogical means for accomplishing the Program Outcomes.

Thus, *Program Outcomes are the pivotal link in the system*, as they provide a visible and measurable linkage between the curriculum and the Educational Objectives. Specifically:

- Each Educational Objective is mapped into to one or more Program Outcomes.
- Each Program Outcome is mapped into one or more courses that contribute to the accomplishment of that outcome.
- The Program Outcomes are a superset of the ABET Criteria 3, 4, and 8 [2].
4.2. CpE Program Specification

4.2.1. CpE Educational Objectives

A computer Engineer views a computer-based system as a continuum of technologies spanning both sides of the traditional analog/digital systems boundary and the traditional hardware/software boundary. The ability to integrate all of these technologies into a single system, and to make hardware/software trade-offs, makes the Computer Engineer uniquely qualified to conceive, design, and build complete computer-based systems to serve a wide variety of applications. We expect that during the first four years following graduation, our graduates will:

1. Function as responsible and ethical members of the profession and society with an understanding of the social and economic ramifications of their work.

2. Successfully apply their knowledge and skills in computer engineering to specify, design, model, implement, program, and test integrated hardware/software systems as creative solutions to engineering problems.

In their professional endeavors, our graduates will:

3. Succeed in entering commercial computer engineering practice as demonstrated by such indicators as:

   a. obtaining their first promotion,
   b. contributing to the competitive edge of their employer,
   c. being a productive member of an engineering team,
   d. demonstrating individual technical capability,
   e. generating high quality technical documentation,
   f. pursuing continuing education.

Or, they will:

4. Succeed in full time graduate studies at highly respected graduate schools as demonstrated by either:

   a. earning a Masters degree, or
   b. having made satisfactory progress toward a Doctorate degree.

4.2.2. CpE Program Outcomes

Graduates of this program shall have demonstrated:

(a) ability to apply knowledge of mathematics, science, and engineering (including knowledge of digital hardware and software) to the solution of engineering problems,

(b) ability to design and conduct experiments, as well as to analyze and interpret data, including statistical analysis methods for experimental estimation of system performance,

(c) ability to design a system, component, or process (including an integrated hardware/software system) to meet desired needs,
(d) ability to function on multi-disciplinary teams, as demonstrated by the execution of a team project that is too large, complex, or diverse for a single person, including the ability to:

1. Execute and evaluate a team Human Resources Inventory,
2. Partition a project into tasks and lay out a project plan,
3. Execute the project and produce the required deliverables,

(e) ability to identify, formulate, and solve engineering problems, including the ability to evaluate hardware/software trade-offs,

(f) understanding of professional and ethical responsibility, including plagiarism, intellectual property issues, the IEEE Code of Conduct, and the NSPE Code of Ethics,

(g) ability to communicate effectively in IEEE-compatible written and oral presentation styles,

(h) receipt of a broad education necessary to understand the impact of engineering solutions in a global and societal context,

(i) recognition of the need for, and an ability to engage in life-long learning,

(j) knowledge of contemporary issues, including:

1. Exposure to the diversity of world cultures and an ability to work with people of different cultural backgrounds.
2. A knowledge of the nature and role of institutions in shaping today’s world.

(k) ability to use relevant techniques, skills, and modern computer-engineering tools, including methods and tools for modeling and simulation of digital system performance and dependability,

(l) ability to function in a major design experience incorporating most of: economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political considerations,

(m) completion of 1 year of mathematics and basic sciences, including experimental experience,

(n) completion of 1.5 years of engineering topics,

(o) completion of a broad, non-technical general education component,

(p) knowledge of discrete math, probability & statistics, calculus, diff. equations, linear algebra, basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing both hardware and software,

(q) proficiency in computer programming, data structures, algorithms, and numerical methods, including familiarity with at least 2 high-level languages, 2 assembly languages, and 1 hardware description language.

(r) depth of knowledge indicated by completion of courses whose prerequisite precedence graph has a depth of at least 3 sequential courses, and by at least 6 credits in one technical elective focus track,

(s) breadth of knowledge spanning the areas of electronics, signal processing, logic design, computer architecture, operating systems, fundamentals of computer science, and technical electives spanning more than one focus track.

4.2.3. CpE Program Component Relationships

This subsection defines the relationships between Educational Objectives, Program Outcomes, Curricular and extra-curricular activities, and relevant ABET criteria.
Program Outcomes are the pivotal elements in the assessment process. Each outcome is a measurable phenomenon that maps to one or more Educational Objectives, and/or to ABET Criteria 3, 4, or 8 [2]. Similarly, the curriculum is mapped directly to outcomes. Thus, Program Outcomes are the link between the curriculum and the Educational Objectives. Table 1 summarizes these relationships.
Table 1: Mapping of CpE Outcomes to Objectives, ABET Criteria, and Courses

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Key: 1 = minor contribution to outcome, 2 = major contribution to outcome.
4.3. EE Program Specification

4.3.1. EE Educational Objectives

Electrical Engineering is a very broad field, having within its scope many areas of specialization. An electrical engineering graduate is qualified to apply a broad base of engineering and science skills to create a wide variety of system solutions and solve an array of technical issues with an emphasis in areas of electrical phenomena. They will have developed specialized emphasis in a particular area of this broad field and have very specific knowledge and technical skills that will allow them to provide support to focused areas of larger solutions. As such, we expect that during the first four years following graduation, our graduates will:

1. Function as responsible and ethical members of the profession and society with an understanding of the social and economic ramifications of their work.

2. Successfully apply their knowledge and skills in electrical engineering in finding creative solutions to engineering problems involving electrical phenomena, devices, or systems.

In their professional endeavors, our graduates will:

3. Succeed in entering commercial electrical engineering practice as demonstrated by such indicators as:
   a. obtaining their first promotion,
   b. contributing to the competitive edge of their employer,
   c. being a productive member of an engineering team,
   d. demonstrating individual technical capability,
   e. generating high quality technical documentation,
   f. pursuing continuing education.

Or, they will:

4. Succeed in full time graduate studies at highly respected graduate schools as demonstrated by either:
   a. earning a Masters degree, or
   b. having made satisfactory progress toward a Doctorate degree.

4.3.2. EE Program Outcomes

As prescribed in ABET EC2000, graduates of this program shall have demonstrated they have the following general engineering traits:

a) the ability to apply knowledge of mathematics, science and engineering
b) the ability to design and conduct experiments, as well as to analyze and interpret data
c) the ability to design a system, component, or process to meet desired needs.
d) ability to function on multi-disciplinary teams, as demonstrated by the execution of a team project that is too large, complex, or diverse for a single person, including the ability to:

   (1) Partition a project into tasks and lay out a project plan,
   (2) Execute the project and produce the required deliverables.

e) the ability to identify, formulate and solve engineering problems

f) an understanding of professional and ethical responsibility

g) the ability to communicate effectively

h) the broad education necessary to understand the impact of engineering solutions in a global and societal context

i) recognition of the need for, and an ability to engage in life-long learning

j) knowledge of contemporary issues, including

   (1) Exposure to the diversity of world cultures and an ability to work with people of different cultural backgrounds.
   (2) A knowledge of the nature and role of institutions in shaping today’s world.

k) the ability to use the techniques, skills, and modern engineering tools necessary for the practice of electrical engineering,

Additionally, the electrical engineering graduates of this program shall also have demonstrated that they have the following:

l) knowledge of probability and statistics, including applications appropriate for electrical engineers.

m) knowledge of mathematics through differential and integral calculus, basic sciences, and engineering sciences necessary to analyze and design complex electrical and electronic devices and systems containing electrical and electronic components

n) knowledge of advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics.

4.3.3. EE Program Component Relationships

This subsection defines the relationships between Educational Objectives, Program Outcomes, Curricular and extra-curricular activities, and relevant ABET criteria.

Program Outcomes are the pivotal elements in the assessment process. Each outcome is a measurable phenomenon that maps to one or more Educational Objectives, and/or to ABET Criteria 3, 4, or 8 [2]. Similarly, the curriculum is mapped directly to outcomes. Thus, Program Outcomes are the link between the curriculum and the Educational Objectives. Table 2 summarizes these relationships.
Table 2: Mapping of EE Outcomes to Objectives, ABET Criteria, and Courses

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Key: 1 = minor contribution to outcome, 2 = major contribution to outcome.
5. Assessment Process

Quality Control and Quality Assurance of the undergraduate programs can only be achieved through a formal process of assessment, evaluation and revision based on the committed and continuous involvement of department administration, the faculty and our constituencies. This section establishes the program assessment processes and procedures for this department.

5.1. Process Structure

The process consists of two separate and concurrent cycles (loops), as defined by the Accreditation Board for Engineering and Technology (ABET), in the Engineering Criteria 2000 (EC2000) accreditation documents [1, 2]. As implemented in this program, the two loops illustrated in Figure 1 have the following properties:

- **The left-hand loop** (or slow loop) represents a three-year cycle focusing on assessment and revision of the high-level Educational Objectives. The goal of this loop is to determine whether the Educational Objectives are relevant, appropriate, and serve the needs of our constituencies. This assessment loop does not attempt to determine how well the current Educational Objectives are being satisfied.

- **The right-hand loop** (or fast loop) represents an annual cycle of activities focusing on assessment and revision of the Program Outcomes and Curriculum to improve the manner in which the program achieves the Educational Objectives defined in the slow loop.

![The Two Loops of EC2000](image)

*Figure 1: Two loop ABET assessment process* [1]
5.2. Target Attributes 

A necessary part of any assessment process is evaluation of the process itself. We therefore establish the following target attributes against which our assessment processes can be evaluated.

1. **Completeness:** Not all Outcomes need to be assessed every year. However, all Outcomes and Objectives must be assessed at least once every three years.

2. **Accountability:** Assessment processes shall provide formal mechanisms for justifying, defining, and documenting actions taken to revise the undergraduate programs and assessment processes. Data that is not reliably observable by the UPC shall not be used for assessment.

3. **Consistency:** The AC shall maintain a single date-stamped Master Copy of each document in a single format. Republishing, reformatting, duplicate storage and/or redundancies between documents shall be strictly avoided, with the following exceptions: (1) blank forms and templates may be provided in multiple file formats, (2) a single copy of each program’s Educational Objectives may be pasted from this SOP onto the department web page, (3) any duplicate versions absolutely demanded by higher authority must contain disclaimers regarding their timeliness and/or correctness.

4. **Sustainability:** Assessment processes shall not impose unsustainable workloads on rank-and-file faculty, department staff, the UPC, the AC, the constituencies or their representative bodies. Rather than attempting to solve all problems in a single year, the process shall identify a manageable subset of the most severe or urgent problems for immediate corrective action.

5. **Efficiency:** Assessment processes shall maximize the amount of processed, useful information delivered relative to the time and resources invested. Philosophical pontification, proselytization, and hyperbole are not useful information and shall be avoided in all documents. In addition, duplication of labor shall be avoided at all costs.

5.3. Implementation and Schedule 

A diverse set of direct and indirect assessment instruments are used to assess Educational Objectives, Program Outcomes, and the assessment process itself. There are two reports to be filed:

1. **Annual Outcomes Assessment Report** from the UPC to the ECE department faculty is due early in the fall semester of every year. This report, defined in Section 7, presents the assessment from the previous academic year and prescribes corrective actions for the current academic year.

2. **Triennial Objectives Assessment Report** from the UPC to the ECE department faculty is due during the spring semester of every third year. This report, defined in Section 8, presents the assessment from the previous cycle and prescribes corrective actions for the current cycle.

Table 3 lists all instruments and reports, the responsible parties, deadlines, and relevance to Objectives level or Outcomes level assessment. The following notes clarify the details of Table 3.

1. All items are due at the end of the week specified in Table 3. As used in Table 3, week “00” means the week before instruction begins, while week “16” means final exams week.

2. Instruments specified to be executed “each” term, need not be executed during summer sessions.

3. All items with deadlines listed as “3rd fall” or “3rd spring” are due every third year, synchronized with the Objectives level assessment cycle. This cycle shall be synchronized so as to occur in the academic year following each ABET program review (generally on a 6-year cycle).
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<td>Course Outcomes Verification (COVer) Forms</td>
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<td>CpE Pre-Capstone Assessment Package (PreCAP)</td>
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<td>Assoc Chair for CpE</td>
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</tbody>
</table>
6. Assessment Instruments

This section provides detailed descriptions of the individual assessment instruments used in the program assessment process. These instruments are to be executed on the schedule shown in Table 3, and used in preparation of the Annual Outcomes Assessment Report and/or Triennial Objectives Assessment Report, as appropriate.

In addition, the UPC may design and/or employ ad-hoc assessment instruments to assess special situations, exploit opportunistic data, obtain more detailed data, and/or experimentally augment the suite of assessment instruments described herein.

Upon completion of each instrument, the AC shall evaluate the results. Evaluation is the process of assigning "value” to assessment data. Care shall be exercised so as not to assign arbitrary values or thresholds simply for the purpose of demonstrating quantification. Rather, the preferred method of evaluating assessment data is rank ordering in order to identify the most severe or urgent problem areas.

Some assessment instruments could be construed to reflect upon the performance of individual faculty members. However, in the interest of achieving objective, unbiased reporting, no assessment instrument or report specified herein shall be made a part of any individual’s tenure or promotion file, with the exception that an individual may voluntarily choose to include data of his/her own choosing in his/her own file at his/her own discretion.
6.1. Prerequisite Review Exam (PRE) Instrument

6.1.1. Purpose
Prerequisite Review Exams (PREs) are given at the beginning of selected EE courses. Each PRE covers prerequisite material for the course in which it is given. PREs are intended to do the following:

- Assess how well prerequisite courses are delivering prerequisite knowledge,
- Non-invasively assess the effectiveness of prerequisite courses taught by other departments,
- Identify systemic weaknesses and omissions across the entire curriculum,
- Demonstrate to students the need to independently review previous material and refresh their knowledge on a regular basis,
- Allow instructors to raise course standards by minimizing the amount of time spent on review.

6.1.2. Implementation

6.1.2.1. Applicable Courses
A PRE is required in each term for all undergraduate courses, including electives (i.e. all course numbers up through 4999), except for courses meeting one or more of the following conditions:

1. a course with no formal prerequisite courses,
2. courses EE-4900, EE-4901, EE-4910,
3. a course which is the second (spring) semester of a two-semester sequence AND the first course in the sequence was taught in the immediately preceding fall AND in the current academic year, both courses are taught by the same instructor.

6.1.2.2. PRE Administration
The content of each PRE is left to the discretion of each instructor. However, PREs are not intended to cover material in extreme depth, to reconstruct the level of detail typical of final exams, or to frighten students away from a course. The breadth and depth of the material should be limited to that which students can reasonably be expected to review and refresh within the limited time allotted.

The form, format, and style of each PRE are left to the discretion of each instructor. For example, it may be an in-class or take-home exam, open book or closed book, a homework assignment, a quiz, a lab practical exam, or any other format that can be graded. However, the following restrictions apply:

1. Do not give a PRE as a pop quiz the first day of a course, as pop quizzes neither generate meaningful assessment data, nor encourage students to review. Therefore, give the students the opportunity to review. This means either give them a study guide for the PRE, or make it take-home,
2. Adhere to the “Prerequisites by Topic” section of the Course Specification.
3. Grade each PRE, and count the grades toward regular credit for the course. Experience has shown that if a PRE only counts as extra credit, then many students do not take it seriously, in which case the results are not meaningful.
4. **Consider** (if practical) grading options that allow the student to compensate for possible inadequate or incomplete coverage of material in a prerequisite course. For example, consider giving a Pass/Fail PRE and/or allowing at least one opportunity to retest, correct, or retry the PRE.

### 6.1.2.3. PRE Reporting

1. **Instructors** shall use the *PRE Report Form* shown in section 6.3.3 to report the results of each PRE. If students are allowed to attempt the PRE more than once, then report only the first attempt scores.

   PRE Report Forms shall be submitted to ECE office staff by the date specified in Table 3. Submit only the report form; *do not attach the actual exams*.

   Instructors are encouraged, *but not required* to partition the PRE into broad topics (as appropriate to the individual course), then itemize each topic and its evaluation on a separate line of the form. If so desired, the instructor may simply report the entire PRE on “Everything Else” line and leave the other lines blank.

   The “Instructor’s Comments” field of the PRE Report Form can be more informative than mere numbers in a table. Instructors may use this section to identify specific strengths or weaknesses that they have uncovered and to make any recommendations that they want the UPC to address.

2. **Department office staff** shall collect the forms and forward them to the AC as soon as practicable after they are collected,

3. **The AC** shall analyze and evaluate PRE statistical results and comments, and report them in the Annual Outcomes Assessment report. In so doing, the AC shall endeavor to explicitly map any identified strengths and weaknesses back to their relevant outcomes.
6.1.3. ECE Department - Prerequisite Review Exam (PRE) Report Form

Crs. Num: ________________ Term: ____________ Instructor: ____________________________

1. **In the Course Spec**: do the items listed under *Prerequisites by Topic* accurately reflect the prerequisite *knowledge* you want students to have for this course? [YES | NO]

2. **In the Course Spec**: are the items listed under *Prerequisites by Topic* consistent with the prerequisite *courses* listed in the catalogue description? [YES | NO]

3. Using the (0-4) scale below, answer the following question for each topic you list: **On average, how satisfactory was the prereq. knowledge demonstrated by the students on your PRE?**

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Severe deficiency.</td>
<td>Some significant weaknesses.</td>
<td>Only minor weaknesses.</td>
<td>Meets the course requirements</td>
<td>Meets the course requirements</td>
<td>Above &amp; beyond requirements</td>
</tr>
</tbody>
</table>

**Return to ECE Secretaries by the end of Week 4 of the term.**
**Do not attach the original exams.**

<table>
<thead>
<tr>
<th>Everything Else (topics not itemized below)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Itemized Topic 1 (Specify)</td>
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<td>2</td>
<td>3</td>
<td>4</td>
</tr>
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<td>2</td>
<td>3</td>
<td>4</td>
</tr>
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<td>2</td>
<td>3</td>
<td>4</td>
</tr>
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<td>Itemized Topic 4 (Specify)</td>
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<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Itemized Topic 5 (Specify)</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**Instructor’s Comments**: Use back of page or attach additional pages if necessary. Your observations and comments can be much more enlightening than mere numerical scores.
6.2. Senior Design Assessment Instruments

6.2.1. Purpose

The senior design course sequence (EE-4900, EE-4901, and 4910) offers the primary opportunity for students to demonstrate abilities to participate in a significant design experience, and to exercise many of the higher-level capabilities required by the Program Outcomes. Because of this unique and pivotal position in the curriculum, the senior design sequence is deserving of special assessment.

6.2.2. Implementation

Each term, two separate instruments shall be executed to assess the effectiveness of the senior design course sequence. They shall be written by the UPC in collaboration with the senior design instructors.

1. **Senior Design Instructor’s Assessment:** Each ECE instructor supervising an EE-4910 design team or an ENG-4960 design team shall complete an instructor’s assessment form for each team supervised. The form shall be written by the UPC in collaboration with the instructors to assess:
   a. How well the design sequence courses fulfill their stated course objectives (as listed in the course specifications),
   b. How well the design sequence courses fulfill their roles relative to the Program Outcomes (as listed in Tables 1 and 2),
   c. Problem areas identified by the instructors,
   d. Instructors’ recommendations for improvement of the course.

2. **Senior Design Sponsor’s Assessment:** Each sponsor representative shall be asked to complete a sponsor’s assessment form. The survey shall be written to assess:
   a. The overall quality of the oral presentations and written reports,
   b. Overall quality of the final designs, including how well they meet the project objectives, and their level of success in producing the specified deliverables,
   c. Problem areas identified by the observers.

Annually, the AC shall analyze and evaluate the statistical results and comments, and report them in the Annual Outcomes Assessment report.

6.2.3. Coverage

Students taking (1) the Enterprise program design sequence with a supervisor from outside the ECE department, or (2) another department’s design sequence, are not covered by this instrument. If a statistically significant number of students start taking these alternative paths, then analogous instruments will need to be developed.
6.3. Undergraduate Advisor’s Assessment Report

6.3.1. Purpose

The department’s undergraduate advisor is uniquely positioned to observe the practicality and workability of the curriculum as a whole. The advisor can provide valuable insights into issues of and the frequency with which waivers are needed, and ease of documenting completion of all degree requirements.

6.3.2. Implementation

Annually, the ECE department’s Undergraduate Advisor shall submit a report to the UPC addressing the practicality and workability of the overall EE and CpE curricula.

6.3.2.1. General:

Topics to be addressed annually include, but are not limited to:

1. the ease of scheduling courses, especially with regard to support departments and programs (e.g. General Education),
2. the frequency with which waivers and exceptions are required,
3. any systemic problems or conflicts observed in achieving and/or documenting the following:
   a. a major design experience via senior design, enterprise, or other means,
   b. 1 year (32 credits) of mathematics and basic sciences, including experimental experience,
   c. 1.5 years (48 credits) of engineering topics,
   d. completion of the MTU General Education requirements.

6.3.2.2. Advising Survey:

In addition, the Undergraduate Advisor shall, on a biennial basis execute, analyze, and evaluate an ECE department Advising Survey to assess the advising services and resources provided to the students.

This survey shall be administered to sophomore, junior and senior students in the fall of odd-numbered years.

The results of the survey shall be included in the advisor’s annual report to the UPC in time for the AC to summarize and include the results in the Annual Outcomes Assessment Report.
6.4. Course Outcomes Verification (COVer) Instrument

6.4.1. Purpose
As written, course specifications may or may not be feasible, complete, or effective. Furthermore, over time, actual course content can diverge from the specification. Thus, in order to “close the loop” on outcomes assessment, it is important to evaluate how well courses actually achieve the outcomes assigned to them by their course specifications. Chronic inability to do so may indicate that the specification is in need of revision.

All Program Outcomes begin with the phrase “shall have demonstrated…”. Verification documents how the students were required to “demonstrate” the required knowledge, abilities, or skills. The person with the most intimate knowledge of actual course content is the actual course instructor. Therefore, the following procedures shall be followed:

6.4.2. Implementation
1. Each actual instructor shall, at the end of each semester, for each course taught:
   a) **Fill out** the Course Outcomes Verification (COVer) Form shown in Subsection 6.4.3.
   b) **Sign** the form on the signature line provided
   c) **Submit** the completed form to the department office staff in order to receive the grade form.

2. Department staff:
   a) Shall not hand out grade form for a given course until they have received the completed and signed COVer form for that course.
   b) When all forms have been collected, forward them to the AC.

3. The AC shall:
   a) Examine the COVer forms to identify chronic problems with a given course, and determine whether action is needed to correct problems identified by the instructors.
   b) Report the results and recommended actions in the Annual Outcomes Assessment Report.
6.4.3. ECE Department - Course Outcomes Verification (COVer) Form

Instructor: ___________________________   Term: __________   Course Number: ______________

<table>
<thead>
<tr>
<th>Course Outcomes and contributing topics (copy directly from the Course Specification)</th>
<th>Highest level to which students were required to <strong>demonstrate</strong> knowledge of each topic (circle one level only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE Outcomes Served (as listed in Course Spec)</td>
<td>A Major Project requiring detailed knowledge</td>
</tr>
<tr>
<td>CpE Outcomes Served (as listed in Course Spec)</td>
<td>No assignments</td>
</tr>
<tr>
<td>Topic Numbers that serve each listed outcome (as listed in Course Spec)</td>
<td>A Few Simple Questions or In-Class Group Exercises</td>
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<tr>
<td></td>
<td>A Few Detailed Quantitative Assignments</td>
</tr>
<tr>
<td></td>
<td>Several Detailed Quantitative Assignments</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>0 1 2 3 4</td>
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<td></td>
<td>0 1 2 3 4</td>
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</table>

*Use extra copies of this page as needed*

*(Continued on Next Page)*
1. For the number of credits, the amount of material required by the course specification is:

<table>
<thead>
<tr>
<th>Way Too Much</th>
<th>A Bit Too Much</th>
<th>Just About Right</th>
<th>A Bit Too Little</th>
<th>Way Too Little</th>
</tr>
</thead>
</table>

2. List any recommendations to the UPC for changes to the Course Specification or requests for other UPC assistance (attach additional sheets if needed).

3. List any advice or suggestions you have for the next instructor to improve course delivery. Assume the next instructor is not yourself (attach additional sheets if needed).
6.5. Progressive Survey Instruments

6.5.1. Purpose

A sequence of surveys solicits feedback from the students and alumni regarding the quality of their education at specific points in their careers. These surveys complement the UAC Outcomes Assessment of Subsection 6.7 in that they permit a comprehensive, quantitative evaluation of students’ opinions.

6.5.2. Implementation

6.5.2.1. Survey Instruments

Three survey instruments shall be used.

1. **ECE Sophomore Surveys** (written by the UPC) shall be given annually in a required course normally taken during a student’s fourth semester.

   These surveys shall focus on courses and activities normally undertaken during the first year of the EE and CpE programs.

2. **ECE Senior Exit Surveys** (written by the UPC) shall be given annually to students enrolled in EE-4910 or an ENG-4960 team supervised by an ECE department instructor. In addition, reasonable efforts shall be taken to include EE and CpE majors taking the final term of another department’s senior design sequence.

   These surveys shall inquire into the undergraduate experience, focusing on outcome achievement, as well as future plans and the status of implementing those plans.

3. **ECE Alumni Outcomes Surveys** (written by the UPC) shall be given annually to Alumni, approximately 12 – 18 months after graduation. The surveys shall focus on outcomes achievement from the alumni perspective in the “real world”.

Annually, the AC shall collect, analyze, and evaluate the survey data, and shall report the results in the Annual Outcomes Assessment Report.

6.5.2.2. Coverage

As implemented, the Sophomore Surveys should cover virtually every student. The Senior Surveys may miss a small number of students taking senior design courses under a different department. If this number becomes statistically significant, then additional effort shall be expended to ensure that they are covered. Alumni Surveys shall reasonably attempt to cover a representative sample of alumni.

6.6.1. Purpose:
To evaluate how ECE graduates perform on the nationally normed Fundamentals of Engineering (FE) exam, relative to the national average. Since CpE graduates do not normally take the FE exam, this instrument primarily assesses the EE program, although the two curricula have much in common.

Given a maximum possible test score of $N_{\text{max}}$ the mean score for department graduates ($N_{\text{mtu}}$) shall be compared to the national mean score ($N_{\text{nat}}$). A department grade $G$ shall be calculated by the formula:

$$G = 2.0 \left[ \frac{N_{\text{mtu}} - N_{\text{nat}}}{N_{\text{max}} - N_{\text{nat}}} \right] + 2.0$$

This formula yields a 4.0 (A) for a perfect score, a 2.0 (C) if the MTU average equals the national average, and less than 2.0 if the MTU average is below the national average.

Using the most recently received test data, the AC shall calculate a value of $G$ for the overall subject test score, the ethics score, and the mathematics score. These results shall be reported in each Annual Outcomes Assessment Report, along with recommendations for corrective actions appropriate to each value of $G$. Any grade near 2.0 or lower is a cause for specific concern.

Scores on all other sections of the FE exam need not be subjected to this metric or reported, unless the AC determines at the time that doing so would be useful for diagnostic purposes.
6.7. CPE Pre-Capstone Assessment Package (PreCAP)

6.7.1. Purpose

The Computer Engineering (CPE) core curriculum culminates in three junior courses EE-3173, EE-3175, and EE-3970. These courses are all prerequisites to the capstone senior design sequence. The intent is that these courses require students to integrate and apply technical and non-technical knowledge and skills acquired throughout the curriculum, in a manner that prepares them for the demands of the capstone design courses. Because of their pivotal roles in the CPE curriculum, these courses afford a unique opportunity to assess several outcomes.

6.7.2. Implementation

Annually, the Associate Chair for CPE shall assemble a team of faculty members to review and assess representative samples student work performed in EE-3173, EE-3175, and EE-3970. As used herein, a “representative sample” comprises three examples of graded work that received grades of “A”, “B”, and “C”, respectively. If this particular distribution of grades is not available, then the instructor shall select examples that approach this distribution as closely as practicable. Specifically:

1. A representative sample of selected laboratory reports from EE-3173 shall be evaluated for the abilities to:
   a. design a system, component, or process to meet a specific need,
   b. implement and test an integrated hardware/software system,
   c. use relevant techniques, skills, and modern computer-engineering tools.

2. A representative sample of modeling and simulation assignments performed in EE-3175 shall be evaluated for the abilities to use:
   a. methods and tools for modeling and simulation of digital system performance,
   b. methods and tools for modeling and simulation of digital system dependability.

3. A representative sample of EE-3970 individual technical writing assignments from late in the term shall be evaluated for the quality of technical writing, and adherence to specified style.

4. A representative sample of human resources inventories, project plans and written reports from the final team projects in EE-3970 shall be evaluated for the abilities to:
   a. design and conduct an experiment,
   b. analyze data in a statistically valid manner,
   c. generate a human resources survey and project plan, execute the project, and publish the results.

For each item above, the chosen evaluators must not include the instructor of the class/section from which the relevant samples were collected.

The team shall report their results to the AC, who shall report them in the Annual Outcomes Assessment Report, along with any recommended action items derived from these results.
6.8. EE Mid-Program Writing Assessment

6.8.1. Purpose
To evaluate the written communication ability of Electrical Engineering (EE) students, a major individual written assignment within EE3120 will be assessed.

6.8.2. Implementation
Each semester, the instructor for EE3120 will assign a major written assignment individually to the students. The assignment will be graded and will be counted as part of the course grade.

In addition, the assignment will be used to assess the writing capabilities of the students. The Instructor will use a rubric similar to the one shown below to determine if the students meet expectations in the quality of the writing, and will then report the following to the Assessment Coordinator in writing:

- The sub-section mean scores and the overall mean score,
- Any other statistics the instructor considers useful,
- Any comments, observations or recommendations drawn from the results.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>0 Unacceptable</th>
<th>2 Below Expectations</th>
<th>4 Meets Expectations</th>
<th>5 Exceeds Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>Inappropriate content in most sections of the report.</td>
<td>Some inappropriate content in some sections of the report.</td>
<td>Content appropriate in all sections of the report</td>
<td>Unique organization enhances readability and/or understanding of report.</td>
</tr>
<tr>
<td>Format</td>
<td>Tables and figures can not be read/understood, fonts difficult to read, so many format errors as to make report useless.</td>
<td>Some portions are sloppy and difficult to read, some format errors.</td>
<td>Text, tables and figures are readable and understandable.</td>
<td>Text, tables, and figures so clear and understandable as to enhance the report's impact, unique format enhances report's impact.</td>
</tr>
<tr>
<td>Grammar, Punctuation, Spelling</td>
<td>Excessive spelling, grammar, and punctuation errors.</td>
<td>Some spelling, grammar and punctuation errors.</td>
<td>Only a few spelling, grammar, or punctuation error.</td>
<td>Completely free of spelling, grammar, and punctuation errors.</td>
</tr>
<tr>
<td>Length</td>
<td>Far too long or too short</td>
<td>Too long or short</td>
<td>Appropriate report length</td>
<td></td>
</tr>
</tbody>
</table>
6.9. UAC Outcomes Assessment

6.9.1. Purpose
The Undergraduate Advisory Committee (UAC) is the primary representative body for student input into the assessment process. Therefore, the UAC shall meet annually with the purpose of assessing the validity and relevance of the program outcomes and how well the program meets its outcomes, from the viewpoint of the current students.

6.9.2. Implementation
Annually, during the spring semester, the following shall occur:

1. The AC shall meet with the committee, to discuss issues related to program outcomes, and brief the committee on the status of all action items in the current Annual Outcomes Assessment Report.

2. The UAC shall meet separately to discuss Program Outcomes issues. The AC shall endeavor to provide the committee with whatever data the committee considers useful in this process.

3. The UAC shall submit a written report to the UPC expressing the UAC viewpoint regarding:
   a) The validity and relevance of the Program Outcomes,
   b) How well the curriculum achieves the Program Outcomes,
   c) The most prominent strengths and weaknesses identified in the curriculum or the assessment process (of particular interest are any items that are not being adequately assessed),
   d) Any recommendations for improving the Program Outcomes and assessment processes.

4. The AC shall include the UAC Outcomes Assessment in the Annual Outcomes Assessment Report, along with any recommended action items generated from them.

6.9.3. Comments and Advice to the UAC
There is a temptation in assessment to try to solve all problems in one year. This approach seldom works, as the workload turns out to be excessive. It is generally better to identify the few most glaring problems and focus on correcting them. Then, the program undergoes a continuous improvement process over years.

The usefulness of the written report will be enhanced if it is short and to the point. Rather than presenting a long “laundry list” of gripes and/or kudos, it is more useful if the UAC prioritizes its comments and provides a “short list” of items (for example, the top 3-5 and bottom 3-5 features or attributes of the program). While recommendations for corrective action can be useful, it is more important to identify and prioritize the most significant problems.

Student surveys should be used sparingly, or not at all. Assessment procedures already call for surveys of sophomores, seniors, and alumni. It is desirable that the UAC report be independent of these surveys.
6.10. ECE Alumni Objectives Survey

6.10.1. Purpose

Educational Objectives are statements of expectations during the first few years after graduation, the most credible source of assessment data is our alumni.

6.10.2. Implementation

ECE Alumni Objectives Surveys (written by the UPC) shall be given annually to Alumni, approximately 3 – 4 years after graduation. The surveys shall focus on Objectives achievement from the alumni perspective in the “real world”.

The AC shall collect, analyze, and evaluate the survey data, and shall report the results in the next Triennial Objectives Assessment Report.
6.11. UAC Objectives Assessment

6.11.1. Purpose
The Undergraduate Advisory Committee (UAC) is the primary representative body for student input into the assessment process. Therefore, the UAC shall meet every three years with the purpose of assessing the validity and relevance of the Educational Objectives from the viewpoint of the students.

6.11.2. Implementation
Every third year, the following shall occur:

1. The AC shall meet with the committee to discuss issues related to Educational Objectives, and brief the committee on the status of all action items in the current Triennial Objectives Assessment Report.

2. The UAC shall meet separately to discuss Educational Objectives issues. The AC shall endeavor to provide the committee with whatever data the committee considers useful in this process.

3. The UAC shall submit a written report to the UPC expressing the committee’s viewpoint regarding:
   a) The validity and relevance of the Educational Objectives,
   b) Any problem areas identified,
   c) Any recommendations for improving the Educational Objectives.

4. The AC shall include the UAC Objectives Assessment in the Triennial Objectives Assessment Report, along with any recommended action items generated from them.
6.12. EAC Objectives Assessment

6.12.1. Purpose
The External Advisory Committee (EAC) is the primary representative body for employer input into the assessment process. Therefore, the EAC shall meet at least once every 3 years with the purpose of assessing the validity and relevance of the Educational Objectives from the viewpoint of the committee.

6.12.2. Implementation
Every third year, the following shall occur:

6. The AC shall meet with the committee to discuss issues related to Educational Objectives, and brief the committee on the status of all action items in the current Triennial Objectives Assessment Report.

7. The EAC shall meet separately to discuss Educational Objectives issues. The AC shall endeavor to provide the committee with whatever data the committee considers useful in this process.

8. The ECE Department chair shall submit a written report from the EAC to the UPC expressing the committee’s viewpoint regarding:
   a) The validity and relevance of the Educational Objectives,
   b) Any problem areas identified,
   c) Any recommendations for improving the Educational Objectives.

9. The AC shall include the EAC Objectives Assessment in the Triennial Objectives Assessment Report, along with any recommended action items generated from them.
6.13. Graduate Committee Objectives Assessment

6.13.1. Purpose
The ECE Department Graduate Committee is the primary representative body for graduate program and graduate student input into the assessment process. Therefore, the Graduate Committee shall meet once every three years for the purpose of assessing the validity and relevance of the undergraduate Educational Objectives from the viewpoint of representative graduate programs.

6.13.2. Implementation
Every third year, the following shall occur:

1. The AC shall meet with the committee to discuss issues related to Educational Objectives, and brief the committee on the status of all action items in the current Triennial Objectives Assessment Report.

2. The Graduate Committee shall meet separately to discuss Educational Objectives issues. The AC shall endeavor to provide whatever data the committee considers useful in this process.

3. The committee shall consider student preparation for graduate study relative to:
   a) our own graduate program and
   b) a representative subset of other CpE and EE graduate programs (selected by the committee).

4. The committee shall submit a written report to the UPC expressing the committee’s viewpoint regarding:
   a) The validity and relevance of the Educational Objectives relative to graduate education,
   b) Their assessment of the quality of preparation of our graduates for graduate study,
   c) Any problem areas identified,
   d) Any recommendations for improving the Educational Objectives.

5. The AC shall include the Graduate Committee Objectives Assessment in the Triennial Objectives Assessment Report, along with any recommended action items generated from them.
7. Annual Outcomes Assessment Report

7.1. Implementation

Program Outcomes shall be subjected to an annual formal review process. The lead entity in the review process shall be the UPC. An Annual Outcomes Assessment Report shall be written for each academic year in accordance with the schedule in Table 3. The process yields three successive versions of the report: the Alpha Draft, Beta Draft, and Final Release versions, respectively.

1. **Alpha Draft**: The AC shall, during the summer, write the Alpha Draft version of the report and make it available to the UPC. The AC shall evaluate data from the formal assessment instruments marked in the “Outcomes” column of Table 3 as well as any other ad-hoc or opportunistic data available. The structure of the report shall include:
   
   a. The itemized status of all “Required Action Items” prescribed in the previous year’s final report,
   
   b. A summary evaluation of the Program Outcomes, including:
      
      i) The effectiveness of the curriculum in achieving the Program Outcomes,
      
      ii) A discussion of items identified in the assessment data which may require action,
      
      iii) The “coverage” of the assessment instruments with respect to Program Outcomes,
   
   c. An evaluation of the Outcomes level assessment process as specified and as practiced during the previous academic year, relative to:
      
      i) The Target Attributes defined in Subsection 5.2,
      
      ii) ABET’s Matrix for Implementation of Assessment [3, Fig. A-1].
      
      iii) Regional criteria similar to item 1.c.ii), if so requested by University authorities.
   
   d. A list of Problems and a list of “Recommended Action Items” for the upcoming academic year. Problems and Action Items shall be prioritized in accordance with Subsection 7.2. In addition, a summary of overall outcomes achievement as measured by the Outcomes Achievement Goals of Subsection 7.3 shall be included.

2. **Beta Draft**: The AC shall submit the Alpha Draft version of the report to the UPC, who shall evaluate it, revise it as necessary, write the Beta Draft version, and submit it to the ECE Faculty. The structure of the Beta Draft is identical to that of the Alpha Draft defined in item 1 above.

3. **Final**: The department faculty shall meet for the purpose of reviewing the Beta Draft of the report, deciding on action items to be accomplished, and publishing a Final Release of the report. The Final Release shall be formatted identically to the Alpha and Beta Drafts defined above, with the exception that the “Recommended Action Items” specified in item 1.d above, shall be replaced by “Required Action Items” approved by the ECE Department faculty.

The AC and the UPC are responsible for overseeing the implementation of the Required Action Items identified in the Final Release.

The AC shall retain on file the 7 most recent Outcomes Assessment Reports (Final Releases only).
7.2. Prioritizing Action Items

Problems and Action Items shall be prioritized in accordance with the following criteria. This approach is a direct adaptation of standardized FMEA methods commonly used in industry [4].

### Failure Modes and Effects Analysis (FMEA)

Each problem identified during the ECE Outcomes assessment process shall be assigned three integer numerical values in the range [1..10], as defined in the three tables below. These values are:

- **S = severity** of the anticipated effects of the problem,
- **C = credibility** of the source of information identifying the problem,
- **R = recurrence** likelihood of the problem if corrective action is not taken.

Within each table, a given problem is likely to match more than one line in the description. When this happens, the problem shall be assigned the largest value corresponding to all matching items.

Finally, a Relative Priority Number (RPN) shall be calculated for each problem as follows:

\[
RPN = S \times C \times R.
\]

Each action item shall be assigned the highest RPN for all problems that the action item is intended to address.

<table>
<thead>
<tr>
<th>Severity (S)</th>
<th>Criteria for Severity of Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td><strong>Failed Outcome:</strong> complete or nearly complete failure to achieve one or more outcomes and/or to assess one or more outcomes</td>
</tr>
<tr>
<td>9</td>
<td><strong>Indeterminate Outcome:</strong> marginal, ambiguous, or indeterminate level of success in achieving one or more outcomes and/or in assessing one or more outcomes</td>
</tr>
<tr>
<td>8</td>
<td><strong>Low Quality Outcome:</strong> less than desirable level of quality in achieving one or more outcomes and/or in assessing one or more outcomes</td>
</tr>
<tr>
<td>7</td>
<td>One or more department programs or processes fail to achieve at least level 4 in one or more categories of the ABET Matrix for Implementation Assessment</td>
</tr>
<tr>
<td>6</td>
<td>The assessment process is deficient in one or more of the Target Attributes specified in Subsec. 5.2</td>
</tr>
<tr>
<td>5</td>
<td>A required course failed to contribute to the outcome(s) assigned to it in Table 1 and/or 2 due to deficiencies in, or failure to adhere to, the course specification</td>
</tr>
<tr>
<td>4</td>
<td>Cohesiveness or completeness of curriculum is compromised or threatened</td>
</tr>
<tr>
<td>3</td>
<td>A required course is now or is likely to become irrelevant or obsolete.</td>
</tr>
<tr>
<td>2</td>
<td>One or more assessment instruments is ineffective or superfluous for assessing the outcomes assigned to that instrument by Table 4.</td>
</tr>
<tr>
<td>1</td>
<td>Negligible effect on outcomes, assessment process, and degree programs</td>
</tr>
<tr>
<td>Credib. (C)</td>
<td>Criteria for Credibility of Indicators</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>10</td>
<td>Beyond a Reasonable Doubt:</td>
</tr>
<tr>
<td></td>
<td>Multiple instruments yielded unanimous strong evidence with no contradictions</td>
</tr>
<tr>
<td>9</td>
<td>Strongly Inconsistent:</td>
</tr>
<tr>
<td></td>
<td>Multiple Instruments yielded both strong evidence and strong contradictions</td>
</tr>
<tr>
<td>8</td>
<td>Highly Credible:</td>
</tr>
<tr>
<td></td>
<td>Multiple Instruments yielded strong evidence with only weak contradictions</td>
</tr>
<tr>
<td>7</td>
<td>Credible:</td>
</tr>
<tr>
<td></td>
<td>A single instrument yielded strong evidence with no contradictions</td>
</tr>
<tr>
<td>6</td>
<td>Ad Hoc Assessment Process Observation:</td>
</tr>
<tr>
<td></td>
<td>Observed and documented by AC or UPC while executing assessment process</td>
</tr>
<tr>
<td>5</td>
<td>Externally Imposed:</td>
</tr>
<tr>
<td></td>
<td>Recommended by an entity external to the department (other than ABET)</td>
</tr>
<tr>
<td>4</td>
<td>Ad Hoc Instructor Observation:</td>
</tr>
<tr>
<td></td>
<td>Observed and documented by instructor(s) in performance of their duties</td>
</tr>
<tr>
<td>3</td>
<td>Weakly Credible:</td>
</tr>
<tr>
<td></td>
<td>One or more instruments yielded weak evidence with no contradictions</td>
</tr>
<tr>
<td>2</td>
<td>Weakly Inconsistent:</td>
</tr>
<tr>
<td></td>
<td>Instruments yielded both weak evidence and weak contradictions</td>
</tr>
<tr>
<td>1</td>
<td>Not credible:</td>
</tr>
<tr>
<td></td>
<td>No credible evidence, or the contradictions are stronger than the evidence</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recurr (R)</th>
<th>Criteria for Likelihood of Problem to Recur (without corrective action)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Nearly 100% chance to appear continuously or annually and <strong>expected</strong> to increase in severity</td>
</tr>
<tr>
<td>9</td>
<td>Nearly 100% chance to appear continuously or annually but <strong>not expected</strong> to increase in severity</td>
</tr>
<tr>
<td>8</td>
<td>At least 50% chance to appear continuously or annually and <strong>expected</strong> to increase in severity</td>
</tr>
<tr>
<td>7</td>
<td>At least 50% chance to appear continuously or annually but <strong>not expected</strong> to increase in severity</td>
</tr>
<tr>
<td>6</td>
<td>Continuous or annual recurrence is a risk, but chances are less than 50% or very difficult to estimate</td>
</tr>
<tr>
<td>5</td>
<td>Intermittent phenomenon with recurrence period estimated as two years</td>
</tr>
<tr>
<td>4</td>
<td>Intermittent phenomenon with recurrence period estimated as more than two years</td>
</tr>
<tr>
<td>3</td>
<td>Transient phenomenon whose impact will self-correct within three or four years</td>
</tr>
<tr>
<td>2</td>
<td>Transient phenomenon whose impact will self-correct within two years</td>
</tr>
<tr>
<td>1</td>
<td>One-time anomaly, almost certain <strong>not</strong> to reoccur</td>
</tr>
</tbody>
</table>
7.3. Outcomes Achievement Goals

In order to establish measurable targets for the achievement of Program Outcomes, the following *Outcomes Achievement Goals* are hereby established:

1. Any outcome that had an RPN $\leq 340$ the previous year shall not exceed an RPN of 340 in the current year.

2. For any outcome that had an RPN of $>340$ in the previous year, its RPN shall have been reduced in the current year.
8. Triennial Objectives Assessment Report

Educational Objectives will be subjected to a formal review process at least once every three years during the spring semester. The review cycle shall be synchronized so that each 2nd review occurs in the academic year immediately following regularly scheduled ABET review visits. The lead entity in the review process shall be the UPC.

The process shall proceed in accordance with the schedule in Table 3. The process yields three successive versions of the report: the Alpha Draft, Beta Draft, and Final Release versions, respectively.

1. **Alpha Draft**: The AC shall write the Alpha Draft version of the report and make it available to the UPC. The AC shall consider summary data and reports from the formal assessment instruments marked in the “Objectives” column of Table 3 as well as any other ad-hoc or opportunistic data available. The structure of the report shall include:
   a. The itemized status of all “Required Action Items” identified in the previous final report,
   b. A summary evaluation of the Educational Objectives, including:
      i) the relevance of the Educational Objectives with respect to the needs of the program constituencies,
      ii) the effectiveness and workability of Objectives assessment process as practiced during the previous cycle.
      iii) A discussion of items identified in the assessment data which may require action,
   c. A list of “Recommended Action Items” for the upcoming academic year,

2. **Beta Draft**: The AC shall submit the Alpha Draft version of the report to the UPC, who shall evaluate it, modify it as necessary, write the Beta Draft version, and submit it to the ECE Faculty for their consideration. The structure of the Beta Draft is identical to that of the Alpha Draft defined in item 1 above.

3. **Final**: The department faculty shall meet for the purpose of reviewing the Beta Draft of the report, deciding on final action items to be accomplished, and publishing a Final Release of the report. The final version shall be formatted identically to the Alpha and Beta Drafts defined above, with the exception that the “Recommended Action Items” in item 1.c shall be replaced by “Required Action Items” approved by the ECE Department faculty.

4. **Addendum**: Following approval of the Final Release, the AC and UPC shall undertake execution of the Required Action Items. The UPC shall then write an Addendum to the Triennial Objectives Assessment Report to report on the status of all Required Action Items mandated in the report. The Addendum shall be submitted to the department faculty within one calendar year of the approval of the Final Release of the report.

The AC shall retain on file the three most recent Objectives Assessment Reports (Final Release and Addendum only).
9. References


