

# **BS in Electrical and Computer Engineering (BSECE) Program**

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## **1. Name of Program**

Electrical and Computer Engineering

## **2. Name of Degree**

Bachelor of Science in Electrical and Computer Engineering (BSECE)

## **3. Responsible Academic Unit**

Department of Electrical and Computer Engineering (ECE)

## **4. Type of Program**

a. Undergraduate bachelors degree program

## **5. Semester Conversion Designation**

a. Re-envisioned with significant changes to program curricular requirements (e.g., changes in core requirements, structural changes to tracks / options / courses), but not changes to program goals.

## **6. Program Learning Goals**

ABET, Inc. is the accrediting body for the undergraduate programs offered by the ECE department. The term “program” is used differently by ABET than as defined by the template for this proposal, or than in Student Information System terminology. Table 6-1 provides a cross-reference between SIS terminology, ABET Terminology, and the colloquial terminology used in this proposal. The ECE department has two ABET accredited programs (ABET usage) under the BSECE degree – an Electrical Engineering Program and a Computer Engineering Program. Internal to OSU and on students’ transcripts the ABET accredited programs are referred to as “specializations.” They will be referred to as the Electrical Engineering Specialization (EES) and Computer Engineering Specialization (CES) in the rest of this proposal.

**Table 6-1:** Cross-reference between SIS terminology, colloquial terminology used in this proposal, and ABET terminology

<b>SIS Terminology</b>	<b>Colloquial Terminology</b>	<b>ABET Terminology</b>
Academic Program = UENG	Undergraduate Engineering	
Academic Plan = ECENG-BS	Bachelor of Science in Electrical and Computer Engineering (BSECE)	
Academic Sub-Plan = EES Academic Sub-Plan Type = Specialization	Electrical Engineering Specialization (EES)	Electrical Engineering Program
Academic Sub-Plan = CES Academic Sub-Plan Type = Specialization	Computer Engineering Specialization (CES)	Computer Engineering Program

In ABET terminology program goals are divided into “objectives” and “outcomes.” Roughly speaking, the former describe what program graduates will be doing a few years after graduation, while the latter pertain to the time of graduation.

The *objectives* of the BSECE Electrical Engineering specialization are:

- I. Graduates apply electrical engineering principles to solve engineering problems and address evolving technological challenges based on a solid foundation in circuits, systems, electromagnetics and devices.
- II. Graduates apply modern electrical engineering techniques, tools, and practices to create and apply technologies to meet the needs of society.
- III. Graduates engage in life-long learning.
- IV. Graduates are effective engineers in the workplace, attend graduate or professional school, or otherwise use the foundation of their technical education to progress in their career.

The *objectives* of the BSECE Computer Engineering specialization are:

- I. Graduates apply computer engineering principles to solve engineering problems and to address evolving technological challenges based on a solid foundation in circuits, systems and computer hardware and software.
- II. Graduates apply modern computer engineering techniques, tools, and practices to create and apply technologies to meet the needs of society.
- III. Graduates engage in life-long learning.
- IV. Graduates are effective engineers in the workplace, attend graduate or professional school, or otherwise use the foundation of their technical education to progress in their career.

Both specializations have as *outcomes* eleven ABET standard outcomes. Each specialization has three additional outcomes. The ABET standard outcomes are that students will attain:

- 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 within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- d. an ability to function on multidisciplinary teams;
- e. an ability to identify, formulate, and solve engineering problems;
- f. an understanding of professional and ethical responsibility;
- g. an ability to communicate effectively;
- h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, 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.

The three additional *outcomes* for the Electrical Engineering Specialization are:

- l. Students have learned a range of technical topics comprising both breadth across circuits, systems, electromagnetics and devices and depth in at least two sub-disciplines within electrical engineering.
- m. Students can apply tools and knowledge, both technical and non-technical, obtained from their undergraduate experience to a major design project.
- n. Graduates are aggressively recruited by both industry and graduate programs.

The three additional *outcomes* for the Computer Engineering Specialization are:

- l. Students have learned a range of technical topics comprising both breadth and depth. Students have learned circuits, systems and computer hardware and software sub-disciplines plus technical elective topics.
- m. Students can apply tools and knowledge, both technical and non-technical, obtained from their undergraduate experience to a major design project.
- n. Graduates are aggressively recruited by both industry and graduate programs.

## **7. BSECE Proposed Program Requirements**

See Attachment #1: BSECE Proposed Requirements – Electrical Engineering Specialization (EES) and Attachment #2: BSECE Proposed Requirements – Computer Engineering Specialization (CES) for the overall structure and list of core courses. The requirements for both specializations are listed, organized into General Education, Engineering Core, ECE-EES or ECE-CES core, and Elective categories. Note that courses toward some General Education categories (e.g. Math, Physical Science, etc.) are listed under Engineering Core or ECE Core categories. The tables in the attachments show the hours of electives without showing detail. The detail of the proposed structure of requirements for Technical Electives and Directed Electives is explained here.

### **Electives in the Electrical Engineering Specialization**

There is a total of 31 hours of ECE Technical Electives and Directed Electives proposed in the Electrical Engineering specialization. The ECE Technical Elective structure, when combined with the required ECE core courses, is designed to provide breadth and depth appropriate to the title of the specialization, per ABET requirements. The rationale for Directed Electives is explained in Section 10 of this proposal.

- At least 16 hours of the Electives must be ECE Technical Electives.
  - Students must take a concentration of 6 hours in one of the curricular domains in the department (currently seven domains).
  - Students must take at least 3 hours in each of two other domains.
  - Students must include at least one 5000 level ECE Technical Elective.
  - At least two ECE Technical Elective courses must be labs or have a lab component.
- Up to 15 hours of the Electives may be Directed Electives from an ECE-approved list. This list will be generated and maintained by the ECE Undergraduate Studies Committee as courses offered by other units become known. Directed Electives generally include:
  - courses required for entry into other engineering majors;
  - required and technical elective courses in other engineering majors;
  - pre-med courses; business or entrepreneurship courses;
  - math, statistics, physics and chemistry courses at higher level than required in the ECE core;
  - and other physical science or biological science courses.
  - For physical science or biological science courses a maximum of 7 hours numbered below 2000 may be counted as Directed Electives.

### **Electives in the Computer Engineering Specialization**

There is a total of 20 hours of ECE/CSE Technical Electives and Directed Electives proposed in the Computer Engineering specialization. The required ECE core provides the breadth appropriate to the Computer Engineering Specialization, and the ECE/CSE Technical Elective structure, which draws on courses both in Electrical and Computer Engineering as well as the department of Computer Science and Engineering (CSE) provides the additional depth appropriate to the title of the specialization, per ABET requirements. The rationale for Directed Electives is explained in Section 10 of this proposal.

- At least 9 hours of the Technical Electives must be ECE or CSE courses selected from a list designated by the ECE Undergraduate Studies Committee in consultation with the ECE Computer area committee.
- Students must include at least one 5000 level ECE or CSE Technical Elective.
- Up to 11 hours of the Electives may be Directed Electives from the ECE approved list. This list will be generated and maintained by the ECE Undergraduate Studies Committee as courses offered by other units become known. Directed Electives generally include:
  - courses required for entry into other engineering majors;
  - required and technical elective courses in other engineering majors;
  - pre-med courses, business or entrepreneurship courses;
  - math, statistics, physics and chemistry courses at higher level than required in the ECE core;
  - and other physical science or biological science courses.
  - For physical science or biological science courses a maximum of 7 hours numbered below 2000 may be counted as Directed Electives.

### Additional Explanations

The following notes provide additional explanation of other sections of the proposed requirements.

- It is expected that ECE majors will be required to select one of their Social Science or Culture and Ideas General Education courses to satisfy an Ethics requirement, from a set of courses designated by the College of Engineering once other departments' offerings and General Education approved courses are known.
- A Math Differential Equations course is included at 3 credit-hr. Earlier versions of this proposal had this course at 4 credit-hr, but it now appears that it will be a 3 credit-hr course. ECE has expressed an interest in enhanced coverage of complex mathematics in the study of differential equations and the Math Department has indicated that they will be able to include this. This change has been balanced by an adjustment to the Directed Electives category to preserve the total hours to degree at 128.
- The College of Engineering is also planning to offer an Interdisciplinary Capstone Design course. ECE majors will be permitted to take Interdisciplinary Capstone Design in place of ECE 4900. Any excess credit hours will count in the Directed Electives category.
- The College of Engineering is also planning to offer a Pre-capstone Design course, which may include significant instruction and feedback on technical communications. When the details of that course are known the ECE Undergraduate Studies Committee will evaluate whether it may satisfy the Technical Communications requirement for ECE majors who wish to take it. If the review is favorable any excess credit hours will count in the Directed Electives category.
- For students not pursuing an undergraduate distinction project, up to a total of 3 hours among 2193 (independent study), 4193 (independent study), 4998.02

(Undergraduate Research) or 4998.02H (Honors Undergraduate Research) can be counted toward ECE Technical Electives or Directed Electives.

- The possibility of allowing additional hours of S/U and in what combination of courses for distinction or honors projects will be addressed after the University policies and College of Engineering policies on honors and distinction projects under semesters are known.

### Additional Requirements

- ABET requires that students in the ECE major have one year (32 credit-hours for the proposed 128 credit-hour program) of college level math and basic science appropriate to the discipline. The core requirements satisfy this for both specializations. However it sometimes happens, most often with transfer students, that a student will have credit for all required math or basic science courses but be short on total hours of math and basic science. In such cases the student will be required to take additional math or basic science courses to meet the 32 credit-hour minimum.
- The ECE department requires that transfer students take a minimum of 30 credit-hours of ECE or CSE courses at OSU (residency requirement). Students may use classes beyond those required for the undergraduate program taken under senior petition to help meet residency.
- A description of the requirements for admission to the ECE major and graduation are presented here. There is no change to the basic policy currently in place, but the list of courses used in the respective point hour ratio calculations is updated to match the proposed semesters curriculum.
  - A student becomes eligible to apply for admission to the ECE major upon completion of Math 1151 and 1172, Physics 1131 & 1132, Chemistry, Engineering 1181 & 1182, and CSE 1222 (or their equivalents). For the admission-to-major selection process OSU grades comprising both the Cumulative Point Hour Ratio (CPHR) and Secondary Point Hour Ratio (SPHR) are considered. The SPHR is the grade point average over all of the courses listed at the beginning of this paragraph. Students must also complete Writing Level I to be admitted to major, but it is not included in the SPHR calculation. First, all students with a CPHR of 3.0 or better are admitted to major. Then for students with a CPHR of 2.0 or better, further admission is based on SPHR. The minimum SPHR for admission is annually adjusted based on the ECE annual admission quota of 230 for enrollment management. However, students with an SPHR below 2.0 will not be admitted, even if the quota is not filled.
  - In addition to University requirements for minimum CPHR for graduation, the Department of Electrical and Computer Engineering requires that students have a Major Point Hour Ratio (MPHR) of 2.0 or greater in all major courses to receive the BSECE degree. For students in EES, major courses are ECE courses (excluding ECE 2300). For student in CES, major courses are ECE courses (excluding ECE 2300), CSE 2221, 2231, 2321, 2451, 2431, and other

higher level CSE courses, to be determined by the ECE Undergraduate Studies Committee once the other CSE course offerings are known.

## **8. Current and Proposed Advising Sheets**

See Attachment #3: Current BSECE advising sheets and Attachment #4: Proposed BSECE advising sheets.

In addition to showing the structure of the curriculum for both specializations and the required classes, the proposed advising sheets list what we expect the technical electives to be at the time of transition to semesters, and for the EES advising sheet, how we expect them to be organized into domains with-in ECE.

The technical electives lie close to the leading edge of the theory and practice of Electrical and Computer Engineering and are necessarily fluid as the field advances. The Department of Electrical and Computer Engineering proposes that changes to which technical electives are listed in which domain and to the names of the domains be determined within the Department of Electrical and Computer Engineering upon recommendation of the ECE Undergraduate Studies Committee and approval by the ECE Curriculum Committee, subject to new courses, course changes, and course withdrawals being approved through regular ECE, College of Engineering and Office of Academic Affairs procedures.

## **9. Curriculum Map**

Attachment #5: Curriculum Map for the Electrical Engineering Specialization and Attachment #6: Curriculum Map for the Computer Engineering Specialization

## **10. Rationale for Program Changes and Description of Changes**

The ECE Undergraduate Studies Committee (USC) and Curriculum Committee (CC), comprised of 16 ECE faculty, have devoted the vast majority of their effort during the 2009-2010 academic year to the redesign of the ECE programs for semesters, with weekly meetings most of the academic year and twice-weekly meetings during particularly busy periods. In addition, the ECE Computer Area Committee provided a great deal of input on the ECE-CES program to USC. An ECE academic advisor also participated in most USC meetings. Another committee, which included student members, was formed to specifically oversee the redesign of the ECE sophomore experience courses. Benchmark data was collected on ECE or similarly named programs at University of California-Berkeley, Georgia Institute of Technology, University of Illinois, Purdue University, University of Michigan, and University of Minnesota. The committees also collected information from our ongoing internal accreditation-based review processes and alumni surveys. The ECE Industrial Advisory Board (IAB) was apprised of the status of our semesters conversion plans at their October 2009 meeting. An all-day ECE faculty retreat was held on 14 January 2010 to review the drafts of the revised ECE programs and collect feedback and input on issues that needed further work. Input from senior undergraduates enrolled in the first course in the ECE capstone design sequence was collected during a meeting with them on 5 February 2010. The input received from that meeting is summarized in a subsection below. The majority of a

second ECE IAB meeting on 9 April, 2010 was devoted to the revised sophomore experience and undergraduate program. Another ECE faculty meeting on 13 April 2010 was held to collect input on a few remaining issues.

- The total hours to degree in the ECE-like programs at the schools we benchmarked against averaged 126.7, with a range of 120 to 132, and half at 128. Direct conversion of our current hours to degree yields 130.7, toward the high end of this range. Early in our transition planning process we decided make a serious effort to reduce the hours toward the middle of the range. We expect this to benefit students by increasing their chances to graduate in four years.
- Most current ECE courses are 3 qtr-cr-hr. Simple conversion would be to 2 sem-cr-hr courses. However we evaluate that requiring students to take 7 or 8 separate courses in a single semester to average the 16 cr-hrs per semester needed to graduate would be a poor learning experience for the students. We decided to target 3 sem-cr-hr as the standard for most ECE lecture courses, with a few 4 sem-cr-hr courses that typically include a lab component, and few special classes at fewer credit hours. This necessitated a redesign of the entire curriculum.
- The most significant enhancement to the ECE undergraduate experience is arguably the redesign of the sophomore experience courses. Students entering the ECE major currently take a set of courses in circuits, digital logic design, electronics and systems, along with two laboratories. Students have recently found these traditionally designed classes to be a let-down following the freshman experience they have in the Introduction to Engineering sequences that were introduced at the last major revision of the Engineering Core. The current introductory laboratory experiments are also often disjoint from the lectures, and implemented using circuit prototyping techniques that are tedious, prone to errors, and difficult to troubleshoot. The proposed new ECE 2000 and 2100 sophomore sequence, replacing four current lecture and two current laboratory courses, is being designed with laboratory experiments that are integrated with the lectures and readily identifiable as linked to applications. The sophomore sequence will use modern tools to continue to provide students with a solid foundation for subsequent courses in their ECE program. It is anticipated that these courses will provide an introduction to ECE that students will find more exciting, and that will better motivate them to invest the effort required to master the ECE foundational material being covered in these classes.
- In the Electrical Engineering Specialization the contents of the “second tier” courses 3010, 3020, 3030, 3040, and 3050, have been redesigned based on the repackaging of foundational material into the sophomore experience courses, changes in the Engineering Core, changing trends in ECE as a field, and the changing needs of society (renewable energy – for example). As actual courses are created from the syllabi faculty are being encouraged to incorporate appropriate use of modern modeling and simulation tools, case studies, design, etc. into the courses to enhance student motivation and learning.
- In the Electrical Engineering Specialization the description of the requirements for the ECE Technical Electives have been simplified, while preserving the requirement for a combination of depth and breadth.

- Faculty, students and the ECE IAB view the variety of technical elective labs that we offer to students under quarters as a strength of our program. Preserving that variety in a change to semesters was a concern, as expanding quarter labs to full semesters would put an unmanageable strain on resources. We have thus proposed a number of 0.5 cr-hr seven-week term labs to allow the variety to be preserved.
- Both of the current specializations in ECE allow Outside Technical Electives, generally considered to be upper level courses in other engineering fields, math and physical sciences. This proposal replaces Outside Technical Electives with Directed Electives (up to 15 hr EES, 11 hr CES – described in section 7) which are intended to increase flexibility for students to take courses from a somewhat broader range than we have traditionally allowed. The flexibility will enable students to pursue an ECE degree while preparing for other professional tracks (e.g. pre-med), select courses in business or entrepreneurship (which many of our alumni cite as helpful in their careers), facilitate the transfer of students into ECE from other majors, regional campuses or other colleges, preserve flexibility for engineering undecided students, and allow students to take courses from other engineering departments to help prepare for Professional Engineer licensure exams.
- General Education and College Core courses are common across the College of Engineering. See the overall College of Engineering Quarter to Semester Conversion Proposal for discussion of the rationale for changes to those parts of the program.
- The last significant program revision was the 2007 revision of the GEC. The previous significant program revision was driven by the Engineering Core revision that went into effect in 2000.

#### Summary of senior student input from 5 February 2010 meeting.

- Some students said that trying to put all of Math 151, 152, 153, and 254 into two semesters would be an overload. We let them know that the math liaison subcommittee of the College of Engineering Core Curriculum and College Services Committee is aware of this concern and is working to select appropriate topics for a two-semester engineering calculus sequence.
- Several students stated that including complex math in math courses taken prior to the semester version of ECE 205 is important. Much of the material from ECE 205 is being incorporated into ECE 2100, proposed for second semester of sophomore year.
- Students asked which courses the integrated sophomore experience will replace. When presented with the list they said they hoped five textbooks would not be required. They were OK with the response that three textbooks were planned. Students were pleased that labs would be integrated in the sophomore experience.
- We asked students if the five “second-tier” courses in the EES program should all be placed on the advising sheet in one quarter or spread out. They thought that attempting to take those five courses in one semester would be an overload. This was one of the factors in our decision to spread them over three semesters on the advising sheet.
- We asked students if they liked the flexibility offered by Directed Electives. Heads were nodding around the room. A student asked about courses taken to prepare for the licensure exams, and we replied that courses from other engineering departments

to help prepare for professional engineer licensure exams would generally fit in this category.

- A few students asked about independent study and number of hours that would be allowed to degree. At the time of this meeting the answer was not known, but it is addressed in Section 7 of this proposal.

### Summary of ECE IAB input from the 9 April 2010 meeting

- IAB recommended we give students the transition spreadsheet (see Section 13 of this proposal) at least a year in advance of the start of semesters. We plan to follow this advise and make the worksheets available to students shortly after the ECE semesters program is approved.
- IAB had the following input specific to the integrated sophomore experience:
  - The instructors will be critical to success of the program. Pick instructors, both faculty and teaching assistants, with passion and desire.
  - Do not make lab groups too big: four is probably too many, two would be optimal, three may be tolerable.
  - The expandable nature of the labs is a big plus (e.g. letting some students build more complicated things for extra credit, like a 16-channel keyboard).
- Some on the IAB questioned whether two semesters of physics is enough. Some IAB members had taken three quarters, others took a full year plus an additional quantum mechanics course. However the need for additional physics is not uniform across the different domains of Electrical and Computer Engineering. Directed Electives allow the flexibility for students to take additional physics.
- We asked the IAB about the first programming course – whether we should required a C/C++ version, a Matlab version, or accept either. They felt that students would obtain a more solid foundation in programming with the C/C++ version, and they also liked the lab component proposed for the C/C++ version. This input contributed to our decision to require the C/C++ version for ECE majors.
- The IAB reinforced the input received from students about having additional exposure to complex mathematics in math classes before applying it in ECE classes.
- The IAB stated that engineering ethics should be handled at the college. Ethics issues are common to all kinds of engineers. Further, having the different majors all taking such a class together represents an opportunity for students to mix. This input has been passed along to the College of Engineering.
- The IAB liked the idea of Directed Electives. They liked the flexibility provided to students.

## 11. Credit Hour Changes

**Table 11-1: Electrical Engineering Specialization**

Program credit hour requirements:	Number of qtr-cr-hrs in current program	Calculated result for 2/3 of current qtr-cr-hrs	Number of sem-cr-hrs required for proposed program
Total cr-hrs required for completion of program	196	130.7	128
Prerequisite cr-hrs required for admission to program which are not counted toward total hours	1	0.7	0
Required cr-hrs offered by the unit	83-98	55.3-65.3	46-61
Required credit hours offered outside the unit	98-113	65.3-75.3	67-82

**Table 11-2: Computer Engineering Specialization**

Program credit hour requirements:	Number of qtr-cr-hrs in current program	Calculated result for 2/3 of current qtr-cr-hrs	Number of sem-cr-hrs required for proposed program
Total cr-hrs required for completion of program	196	130.7	128
Prerequisite cr-hrs required for admission to program which are not counted toward total hours	1	0.7	0
Required cr-hrs offered by the unit	57-75	38-50	25-45
Required cr-hrs offered outside the unit	121-139	80.7-92.7	83-103

In both of these tables the smaller value in the range of required cr-hrs offered by ECE is the ECE core plus the minimum required ECE Technical Electives. The larger value corresponds to a student selecting ECE courses for all Technical Electives and Directed Electives.

The converse is true for the required cr-hrs offered outside of ECE - the minimum corresponds to a student selecting ECE courses for all Technical and Directed Electives.

## 12. Rationale for Significant Change in Credit Hours

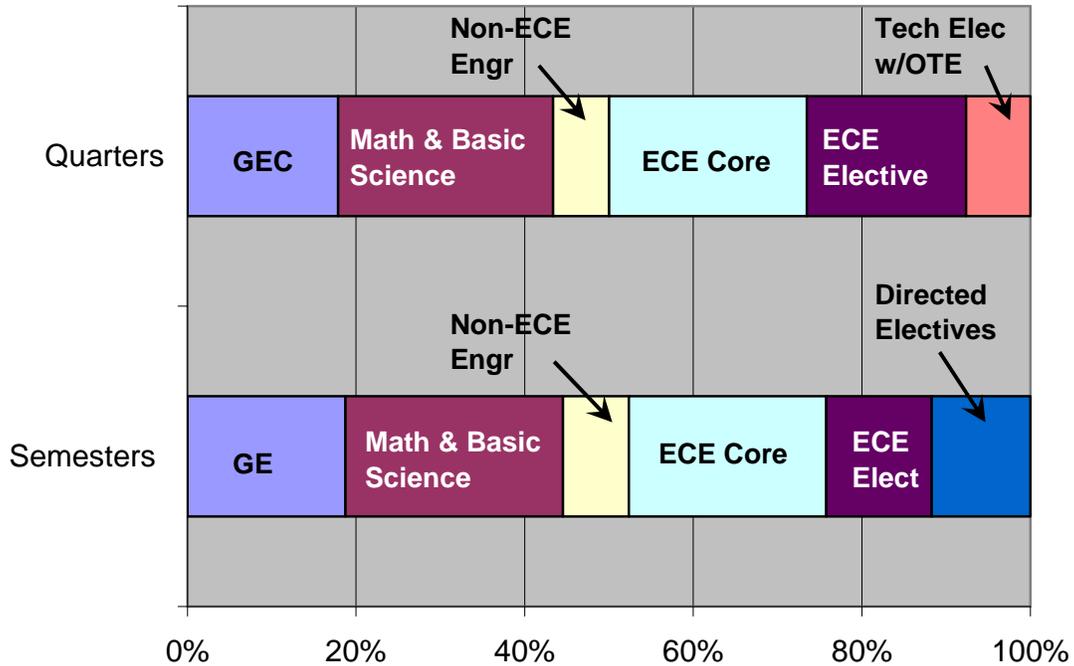
(Required for changes of more than 4 semester hours in any row of the tables in Section 11.)

As shown in Table 11-1 and Table 11-2, the number of required semester credit hours offered by ECE is reduced by more than 4 and the number of required semester hours offered outside ECE is increased by more than 4 for both ECE-EES and ECE-CES. While these changes exceed the threshold of 4 cr-hr for additional explanation, they are a result of an accumulation of smaller changes in other categories of the program. In the

following discussion all qtr-cr-hrs for the current program have been converted into sem-cr-hr equivalents by multiplying by 2/3.

### Electrical Engineering Specialization

Figure 12-1 presents a graphical comparison of the current quarters requirements to the proposed semesters requirements for the ECE-EES program, with finer division than shown in Table 11-1.



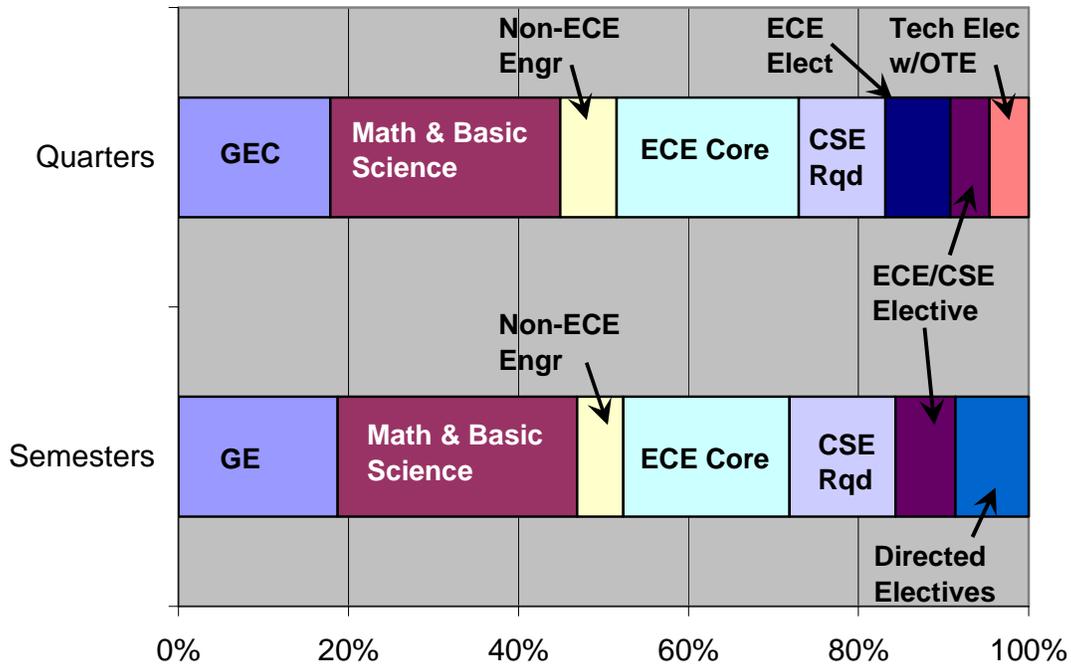
**Figure 12-1:** Comparison of current EES quarters program and proposed semesters program by category

A variety of factors contribute to the 9.3 reduction in required cr-hrs offered by ECE shown in Table 11-1. The total hours to degree is reduced by 2.7 cr-hr. The general education, math and basic science, and non-ECE Engineering categories combine for another 1.7 cr-hr of the difference. The largest factor in the change is our decision to provide more flexibility to students by the transition from 10 sem-cr-hr of Outside Technical Electives to 15 cr-hr of Directed Electives. Note that for a student who elects to take all ECE courses for their Directed Electives the reduction in ECE cr-hrs is entirely accounted for by the reduction in hours to degree and increase in general education, math and basic science, and non-ECE Engineering cr-hrs.

The proposed BSECE-EES program requires a minimum of 46 sem-cr-hr of ECE classes with 30 sem-cr-hr being required ECE core classes and 16 sem-cr-hr from ECE Technical Electives. For the current quarters program, the semester equivalent values are 55.3 sem-cr-hr for the total, 30.7 for the required core, and 24.7 for ECE Technical Electives.

## Computer Engineering Specialization

Figure 12-2 presents a graphical comparison of the current quarters requirements to the proposed semesters requirements for the ECE-CES program, with finer division than shown in Table 11-2. Since required CSE courses are a substantial part of the ECE-CES program they are also broken out as a separate category. In the new proposed program the only required ECE courses are in the ECE-CES core. Technical Electives are selected from a list containing both ECE and CSE courses.



**Figure 12-2:** Comparison of current CES quarters program and proposed semesters program by category

A variety of factors contribute to the 13 cr-hr reduction in required cr-hrs offered by ECE shown in Table 11-2. The total hours to degree is reduced by 2.7 cr-hr. The general education, and the math and basic science categories combine for another 1.4 cr-hr of the difference. The inclusion of Engineering 1100 in the requirements for degree increases the non-ECE/CSE Engineering category by 1 cr-hr, but overall this category is reduced by 1.7 cr-hr since the introductory programming course is moved into the CSE category, which is increased by 2.7 cr-hr.

Those changes leave only 44 cr-hrs for the required core ECE courses and electives, compared to 50 sem-cr-hrs equivalent for the current program. Of this reduction, three hours appear in the required ECE core, and three in electives. The proposed program requires 25 cr-hr of ECE courses in the ECE-CES core.

To increase the flexibility for students, we decided to divide the remaining 20 cr-hr into just two categories, ECE/CSE Technical Electives (9 cr-hr) and Directed Electives (11 cr-

hr), compared to the current, more restrictive, three categories. Combining ECE and CSE Technical Electives into a single category lowered the minimum required cr-hrs offered by ECE by 10.

Note that for a student who elects to take all ECE courses for their Technical and Directed Electives the reduction in ECE cr-hrs is entirely accounted for by the reduction in hours to degree and increases in general education, math and basic science, and non-ECE Engineering cr-hrs.

### **13. Transition Policy**

No BSECE major who began the degree program under quarters will have progress toward graduation impeded by the transition to semesters. These students will be given a choice of fulfilling either the quarter requirements or the semester requirements. For students who elect to fulfill the quarters requirements, semesters courses that count toward the ECE major under the semesters-based ECE program will be mapped onto quarter requirements (with a factor of 3/2 conversion for credit hours). For students who elect to fulfill the semesters requirements, quarters courses that counted toward the ECE major under the quarters-based ECE program will be mapped onto semester requirements (with a factor of 2/3 conversion for credit hours). Advising support will be provided for BSECE majors to assist them in assessing which requirements to elect, and to assist them in planning their course schedules before and after the transition to semesters. If it is determined that the standard ECE transition plans would result in a particular student facing an unavoidable delay in graduation due to the change to semesters – *rather than the student's failure to meet with an advisor to complete the transition worksheet or to make satisfactory progress through the mutually agreed program plan* – then custom arrangements to meet specific requirements will be worked out for that student by the advising staff with approval of the ECE Undergraduate Studies Committee, but program requirements must be met.

— Robert Lee, ECE Department Chair

Statements of the principles for four transition policies follow:

1. ECE-EES students fulfilling quarters requirements
2. ECE-CES students fulfilling quarters requirements
3. ECE-EES students fulfilling semesters requirements
4. ECE-CES students fulfilling semesters requirements

## **Transition Principles**

The Department of Electrical and Computer Engineering proposes to allow students present during the transition the choice of either continuing to fulfill quarter requirements or switching to semester requirements. Thus four sets of transition principles are required – two for the EES program and two for the CES program. In each case there are requirements that specific topics be completed, and other requirements that a specified number of credit hours be taken in certain categories. These different types of requirements are not mutually exclusive – courses taken to meet topical requirements may also count toward a credit hour requirement in one or more categories. This section describes these different types of requirements.

Students present during the transition will in general be meeting these requirements with a mix of quarter and semester courses. Since the curricula of the ECE programs and the ECE courses have been redesigned and not just translated from quarters to semesters there will usually be mismatches between hours earned toward specific topic requirements met with quarter courses vs. semester courses. This section also describes how these mismatches in hours earned will be managed.

For students who elect to meet the requirements of the quarter curriculum for their program, credit hour requirements will be stated in terms of equivalent qtr-cr-hrs, calculated by multiplying sem-cr-hrs earned after the transition by  $3/2$  and adding that to the number of qtr-cr-hrs earned before the transition.

For students who elect to meet the requirements of the semester curriculum for their program, credit hour requirements will be stated in terms of equivalent sem-cr-hrs, calculated by multiplying qtr-cr-hrs earned before the transition by  $2/3$  and adding that to the number of sem-cr-hrs earned after the transition.

A mathematical description of the various requirements is presented in Attachment #7: Transition Principles – concise form with equations.

### **Total hours to degree**

This specifies the minimum number of hours to degree. The requirement is the same for the EES and CES programs. Students who elect to meet quarter requirements must achieve the equivalent of at least 196 qtr-cr-hrs. Students who elect to meet semester requirements must achieve the equivalent of at least 128 sem-cr-hrs.

This requirement will largely be met by completing the requirements of each of the categories described later in this section. But, due to the mix of quarters and semesters courses used to meet those requirements, it is possible a student may satisfy each of the categories but still be short a few hours toward the total to degree. In such a case the student must take additional courses to meet this minimum.

## **GEC/GE**

This is a requirement that specific topics be satisfied. Students accepted into the College of Engineering after the start of semesters will be required to satisfy the eight GE liberal arts requirements of the semester system, as described in the College of Engineering Core proposal. Any student accepted into the College of Engineering prior to the start of semesters will be required to satisfy the seven GEC liberal arts requirements of the quarter system, also as described in the College of Engineering Core proposal. They may use either quarter courses or semester courses to fulfill each of the requirements. This will be in effect until the Summer of 2017 at which time those students will be required to meet the semester GE liberal arts requirements.

## **Core**

The topics in the Core are identified by the courses listed in the Core section of the advising sheets in Attachment #3 and Attachment #4. Note that the Core includes Math and Basic Science (MBS) courses, as well as ECE, CSE and other required courses. Thus there is overlap between the Core topical requirements and the MBS credit hour requirements. There are differences in how mismatches in credit hours will be handled for students who elect to meet quarter requirements vs. those who elect to meet semester requirements in both the EES and CES programs, so they will be described in four separate discussions.

### Core – EES Program – Quarter Requirements

For EES students who elect to meet quarter requirements a mapping of semester courses onto quarter requirements will be used to assign credit for meeting specific course requirements. This is shown in Table 13-1.

**Math and Basic Science:** Students who elect to meet quarter requirements must achieve the equivalent of at least 48 qtr-cr-hrs of Math and Basic Science. This stems from ABET accreditation requirements. If, in the transition from quarter to semesters, the mix of quarter and semester courses taken by a student to meet the topical MBS requirements results in equivalent qtr-cr-hrs below the minimum, they must take additional MBS courses to satisfy the minimum. Students may use courses that also count as Outside Technical Electives for this. If the mix of quarter and semester courses used to meet MBS topical requirements results in more than 50 equivalent qtr-cr-hrs, those excess hours will count toward Outside Technical Electives.

**ECE Topical Core:** If the mix of quarter and semester courses used to meet ECE topical requirements results in fewer than 43 equivalent qtr-cr-hrs, the student will be required to take additional ECE Technical Electives to make up the difference. If the mix of quarter and semester courses used to meet ECE topical requirements results in more than 43 equivalent qtr-cr-hrs, those excess hours will count toward ECE Technical Electives.

**Non-ECE, non-MBS:** Similarly, credit mismatches resulting from the mix of quarter and semester courses used to meet non-ECE, non-MBS topical requirements will either add to or subtract from technical electives in the Outside Technical Elective category, based on the difference from 16 equivalent qtr-cr-hrs.

**Table 13-1:** EES program core - for students meeting quarter requirements. The table is broken into three sections to facilitate explanation of how mismatches in credit hour requirements will be handled.

Quarter Requirement	qtr-cr-hr	Semester Courses	sem-cr-hr	Equiv qtr-cr-hr	Excess equiv qtr-cr-hr
Math 151, 152, 153 & 254	20	Math 1151 & 1172	10	15.0	-5.0
Math 415	4	Math 2415	3	4.5	0.5
Math 571	3	Math 2568	3	4.5	1.5
Physics 131, 132 & 133	15	Physics 1131 & 1132	10	15.0	0.0
Chemistry 121	5	Chemistry for Engr	4	6.0	1.0
Statistics 427	3	Statistics 4278	3	4.5	1.5
<b>Total MBS</b>	<b>50</b>			<b>49.5</b>	

Engr 181	3	Engr 1181	2	3.0	0.0
Engr 183	3	Engr 1182	2	3.0	0.0
EnGraph 167	4	CSE 1222	3	4.5	0.5
ECE 331*	3	MSE 2010	3	4.5	1.5
Ind Eng 504	3	ISE 3040	2	3.0	0.0
<b>Total Non-ECE/Non-MBS</b>	<b>16</b>			<b>18.0</b>	

ECE 205, 206, 209, 261, 301 & 351	15	ECE 2000 & 2100	8	12.0	-3.0
ECE 265	3	ECE 2560	2	3.0	0.0
ECE 311 & 312	6	ECE 3010	3	4.5	-1.5
ECE 323	3	ECE 3020	3	4.5	1.5
ECE 432	3	ECE 3030	3	4.5	1.5
ECE 341	3	ECE 3040	3	4.5	1.5
ECE 352	3	ECE 3050	3	4.5	1.5
ECE 481	1	ECE 3080	1	1.5	0.5
ECE 582	3	ECE 3090	1	1.5	-1.5
ECE 682	3	ECE 4900	3	4.5	1.5
<b>Total ECE</b>	<b>43</b>			<b>46.5</b>	
* ECE 331 is included with Non-ECE/Non-MBS since it is a required course that also meets a college selected core requirement, and a semester course to meet that selected core topic will not be offered by ECE.					

Core – CES Program – Quarter Requirements

For CES students who elect to meet quarter requirements a mapping of semester courses onto quarter requirements will be used to assign credit for meeting specific course requirements. This is shown in Table 13-2.

Math and Basic Science: Students who elect to meet quarter requirements must achieve the equivalent of at least 48 qtr-cr-hrs of Math and Basic Science. This stems from ABET accreditation requirements. If, in the transition from quarter to semesters, the mix of quarter and semester courses taken by a student to meet the topical MBS requirements results in equivalent qtr-cr-hrs below the minimum, they must take additional MBS courses to satisfy the minimum. Students may use courses that also count as Outside

Technical Electives for this. If the mix of quarter and semester courses used to meet MBS topical requirements results in more than 53 equivalent qtr-cr-hrs, those excess hours will count toward Outside Technical Electives.

**Table 13-2:** CES program core - for students meeting quarter requirements. The table is broken into three sections to facilitate explanation of how mismatches in credit hour requirements will be handled.

Quarter Requirement	qtr-cr-hr	Semester Courses	sem-cr-hr	Equiv qtr-cr-hr	Excess equiv qtr-cr-hr
Math 151, 152, 153 & 254	20	Math 1151 & 1172	10	15.0	-5.0
Math 415	4	Math 2415	3	4.5	0.5
Math 571	3	Math 2568	3	4.5	1.5
Math 366	3	Math 3366 or CSE 2321	3	4.5	1.5
Physics 131, 132 & 133	15	Physics 1131 & 1132	10	15.0	0.0
Chemistry 121	5	Chem for Engr	4	6.0	1.0
Statistics 427	3	Statistics 4278	3	4.5	1.5
<b>Total MBS</b>	<b>53</b>			<b>54.0</b>	

Engr 181	3	Engr 1181	2	3.0	0.0
Engr 183	3	Engr 1182	2	3.0	0.0
EnGraph 167	4	CSE 1222	3	4.5	0.5
CSE 221, 222 & 321	12	CSE 2221 & 2231	8	12.0	0.0
CSE 560	5	CSE 3901	4	6.0	1.0
CSE 660	3	CSE 2451 & 2431	5	7.5	4.5
ECE 331*	3	MSE 2010	3	4.5	1.5
Ind Eng 504	3	ISE 3040	2	3.0	0.0
<b>Total Non-ECE/Non-MBS</b>	<b>36</b>			<b>43.5</b>	

ECE 205, 206, 209, 261, 301 & 351	15	ECE 2000 & 2100	8	12.0	-3.0
ECE 265	3	ECE 2560	2	3.0	0.0
ECE 323	3	ECE 3020	3	4.5	1.5
ECE 352	3	ECE 3050	3	4.5	1.5
ECE 561	3	ECE 3367	3	4.5	1.5
ECE 567	3	ECE 3567	1	1.5	-1.5
ECE 662	3	ECE 5362	3	4.5	1.5
ECE 481	1	ECE 3080	1	1.5	0.5
ECE 582	3	ECE 3090	1	1.5	-1.5
ECE 682	3	ECE 4900	3	4.5	1.5
<b>Total ECE</b>	<b>40</b>			<b>42.0</b>	

\* ECE 331 is included with Non-ECE/Non-MBS since it is a required course that also meets a college selected core requirement, and a semester course to meet that selected core topic will not be offered by ECE.

ECE Topical Core: If the mix of quarter and semester courses used to meet ECE topical requirements results in fewer than 40 equivalent qtr-cr-hrs, the student will be required to take additional ECE Technical Electives to make up the difference. If the mix of quarter

and semester courses used to meet ECE topical requirements results in more than 40 equivalent qtr-cr-hrs, those excess hours will count toward ECE Technical Electives.

Non-ECE, non-MBS: Similarly, credit mismatches resulting from the mix of quarter and semester courses used to meet non-ECE, non-MBS topical requirements will either add to or subtract from technical electives in the Outside Technical Elective category, based on the difference from 36 equivalent qtr-cr-hrs.

Core – EES Program – Semester Requirements

For EES students who elect to meet semester requirements a mapping of quarter courses onto semester requirements will be used to assign credit for meeting specific course requirements. This is shown in Table 13-3.

**Table 13-3:** EES program core - for students meeting semester requirements. The table is broken into three sections to facilitate explanation of how mismatches in credit hour requirements will be handled.

Semester Requirement	sem-cr-hr	Quarter Courses	qtr-cr-hr	Equiv sem-cr-hr	Excess equiv sem-cr-hr
Math 1151 & 1172	10	Math 151, 152, 153 & 254	20	13.33	3.33
Math 2415	3	Math 415	4	2.67	-0.33
Math 2568	3	Math 571	3	2.00	-1.00
Physics 1131 & 1132	10	Physics 131, 132 & 133	15	10.00	0.00
Chem for Engr	4	Chemistry 121	5	3.33	-0.67
Statistics 4278	3	Statistics 427	3	2.00	-1.00
<b>Total MBS</b>	<b>33</b>			<b>33.33</b>	

Engr 1100	1	Engr 100	1	0.67	-0.33
Engr 1181	2	Engr 181	3	2.00	0.00
Engr 1182	2	Engr 183	3	2.00	0.00
CSE 1222	3	EnGraph 167	4	2.67	-0.33
ISE 3040	2	Ind Eng 504	3	2.00	0.00
<b>Total Non-ECE/Non-MBS</b>	<b>10</b>			<b>9.33</b>	

ECE 2000 & 2100	8	ECE 294.01, 294.02 & 294.03	12	8.00	0.00
ECE 2560	2	ECE 265	3	2.00	0.00
ECE 3010	3	ECE 311 & 312	6	4.00	1.00
ECE 3020	3	ECE 323	3	2.00	-1.00
ECE 3030	3	ECE 331 & 432	6	4.00	1.00
ECE 3040	3	ECE 341	3	2.00	-1.00
ECE 3050	3	ECE 352	3	2.00	-1.00
ECE 3080	1	ECE 481	1	0.67	-0.33
ECE 3090	1	ECE 582	3	2.00	1.00
ECE 4900	3	ECE 682	3	2.00	-1.00
<b>Total ECE</b>	<b>30</b>			<b>28.67</b>	

Math and Basic Science: Students who elect to meet semester requirements must achieve the equivalent of at least 32 sem-cr-hrs of Math and Basic Science. This stems from

ABET accreditation requirements. If, in the transition from quarter to semesters, the mix of quarter and semester courses taken by a student to meet the topical MBS requirements results in equivalent sem-cr-hrs below the minimum, they must take additional MBS courses to satisfy the minimum. Students may use MBS courses from the Directed Elective list for this. If the mix of quarter and semester courses used to meet MBS topical requirements results in more than 33 equivalent sem-cr-hrs, those excess hours will count toward Directed Electives.

ECE Topical Core: If the mix of quarter and semester courses used to meet ECE topical requirements results in fewer than 30 equivalent sem-cr-hrs, the student will be required to take additional ECE Technical Electives to make up the difference. If the mix of quarter and semester courses used to meet ECE topical requirements results in more than 30 equivalent sem-cr-hrs, those excess hours will count toward ECE Technical Electives.

Non-ECE, non-MBS: Similarly, credit mismatches resulting from the mix of quarter and semester courses used to meet non-ECE, non-MBS topical requirements will either add to or subtract from the Directed Elective category, based on the difference from 10 equivalent sem-cr-hrs.

#### Core – CES Program – Semester Requirements

For CES students who elect to meet semester requirements a mapping of quarter courses onto semester requirements will be used to assign credit for meeting specific course requirements. This is shown in Table 13-4.

Math and Basic Science: Students who elect to meet semester requirements must achieve the equivalent of at least 32 sem-cr-hrs of Math and Basic Science. This stems from ABET accreditation requirements. If, in the transition from quarter to semesters, the mix of quarter and semester courses taken by a student to meet the topical MBS requirements results in equivalent sem-cr-hrs below the minimum, they must take additional MBS courses to satisfy the minimum. Students may use MBS courses from the Directed Elective list for this. If the mix of quarter and semester courses used to meet MBS topical requirements results in more than 36 equivalent sem-cr-hrs, those excess hours will count toward Directed Electives.

ECE and CSE Topical Core: If the mix of quarter and semester courses used to meet ECE and CSE topical requirements results in fewer than 37 equivalent sem-cr-hrs, the student will be required to take additional ECE or CSE Technical Electives to make up the difference. If the mix of quarter and semester courses used to meet ECE and CSE topical requirements results in more than 37 equivalent sem-cr-hrs, those excess hours will count toward ECE/CSE Technical Electives.

Non-ECE/CSE, non-MBS: Similarly, credit mismatches resulting from the mix of quarter and semester courses used to meet non-ECE/CSE, non-MBS topical requirements will either add to or subtract from the Directed Elective category, based on the difference from 10 equivalent sem-cr-hrs.

**Table 13-4:** CES program core - for students meeting semester requirements. The table is broken into three sections to facilitate explanation of how mismatches in credit hour requirements will be handled.

Semester Requirement	sem-cr-hr	Quarter Courses	qtr-cr-hr	Equiv sem-cr-hr	Excess equiv sem-cr-hr
Math 1151 & 1172	10	Math 151, 152, 153 & 254	20	13.33	3.33
Math 2415	3	Math 415	4	2.67	-0.33
Math 2568	3	Math 571	3	2.00	-1.00
Math 3366 or CSE 2321	3	Math 366	3	2.00	-1.00
Physics 1131 & 1132	10	Physics 131, 132 & 133	15	10.00	0.00
Chem for Engr	4	Chemistry 121	5	3.33	-0.67
Statistics 4278	3	Statistics 427	3	2.00	-1.00
<b>Total MBS</b>	<b>36</b>			<b>35.33</b>	<b>-0.67</b>
Engr 1100	1	Engr 100	1	0.67	-0.33
Engr 1181	2	Engr 181	3	2.00	0.00
Engr 1182	2	Engr 183	3	2.00	0.00
CSE 1222*	3	EnGraph 167	4	2.67	-0.33
ISE 3040	2	Ind Eng 504	3	2.00	0.00
<b>Total Non-ECE&amp;CSE/Non-MBS</b>	<b>10</b>			<b>9.33</b>	<b>-0.67</b>

ECE 2000 & 2100	8	ECE 294.01, 294.02 & 294.03	12	8.00	0.00
ECE 2560	2	ECE 265	3	2.00	0.00
ECE 3020	3	ECE 323	3	2.00	-1.00
ECE 3367	3	ECE 561 & ECE 667	6	4.00	1.00
ECE 5362	3	ECE 662	3	2.00	-1.00
ECE 3080	1	ECE 481	1	0.67	-0.33
ECE 3090	1	ECE 582	3	2.00	1.00
ECE 4900	3	ECE 682	3	2.00	-1.00
CSE 2221 & 2231	8	CSE 221, 222 & 321	12	8	0
CSE 2451	2	no quarter equivalent	0	0	-2
CSE 2431	3	CSE 660	3	2.00	-1.00
<b>Total ECE&amp;CSE</b>	<b>37</b>			<b>32.67</b>	

\* The programming course CSE 1222 is not included with the other CSE courses since it is a pre-major course that must be completed prior to acceptance into the major.

### Selected Core

The Selected Core requirement is a College of Engineering quarter core requirement. In the EES and CES programs most of the courses to meet this requirement are specified and are thus included in the ECE EES or CES core, but some are left to student choice, from a pick list. The requirements are different for the EES and CES programs, so each will be described in a separate paragraph.

A student in the EES program who elects to meet quarter requirements must achieve the equivalent of at least 3 qtr-cr-hrs from the EES Selected Core pick list. A maximum of 9 qtr-cr-hrs from the EES Selected Core pick list is allowed. Semester courses comparable

to those on the EES Selected Core pick list may be used. The EES Selected Core pick list is shown on the current advising sheet in Attachment #3. The allowed Selected Core credits count against Outside Technical Electives.

A student in the CES program who elects to meet quarter requirements is not required to take any additional courses from the CES Selected Core pick list as the minimum College of Engineering Selected Core requirements are met by courses required in the CES program. However they are permitted to count up to 9 qtr-cr-hrs from the CES Selected Core pick list against Outside Technical Electives. Semester courses comparable to those on the CES Selected Core pick list may be used. The CES Selected Core pick list is shown on the current advising sheet in Attachment #3.

For students in either the EES or CES program who elect to meet semester requirements, there is no Selected Core requirement. However it is possible that such a student may have already taken Selected Core courses prior to the transition to semesters. In such a case, any of those courses that would have met quarter Selected Core requirements for their program that do not meet semester Core requirements in their program will count as Directed Electives.

### **ECE Technical Electives**

Since the technical elective requirements are different for the EES and CES programs, and also different for the quarter curriculum and semester curriculum, each will be described in a separate discussion.

#### ECE Technical Electives – EES Program – Quarter Requirements

EES students who elect to meet quarter requirements must take at least 37 equivalent qtr-cr-hrs of ECE Technical Electives. (This leaves up to 15 equivalent qtr-cr-hrs of technical electives outside ECE, including Selected Core.) The ECE Technical Elective requirement has additional structure. The student must take at least 11 equivalent qtr-cr-hrs in one area of concentration, with at least one 700-level quarter course or 5000-level semester course. In addition the student must take either:

- A second area of concentration with at least 11 equivalent qtr-cr-hrs and at least one 700-level quarter course or 5000-level semester course, or
- Two additional areas of concentration with at least 5 equivalent qtr-cr-hrs each.

The student must also take at least 7 equivalent qtr-cr-hrs of ECE Technical Elective labs. The labs may also count toward meeting the areas of concentration requirements.

Quarter courses in each of the areas of concentration are listed on the current advising sheets in Attachment #3. Semester courses that would count in each of the areas of concentration are listed on the proposed semester advising sheets in Attachment #4 (called domains on the semester advising sheet).

#### ECE Technical Electives – CES Program – Quarter Requirements

CES students who elect to meet quarter requirements must take at least 15 equivalent qtr-cr-hrs of ECE Technical Electives. (This leaves up to 18 equivalent qtr-cr-hrs of technical electives outside ECE, including Selected Core.) The Technical Elective requirement has additional structure. The student must take at least 12 equivalent qtr-cr-

hrs from a pick list of ECE and CSE courses. (See the current advising sheet in Attachment #3 for the pick list.) Semester courses that are available to undergraduates that are comparable to those on the current pick list may be used. ECE courses selected from this pick list also count toward the 15 qtr-cr-hr ECE Technical Elective requirement.

#### ECE Technical Electives – EES Program – Semester Requirements

EES students who elect to meet semester requirements must take at least 16 equivalent sem-cr-hrs of ECE Technical Electives. (This leaves up to 15 equivalent sem-cr-hrs of Directed Electives outside ECE.) The ECE Technical Elective requirement has additional structure. The student must take at least 6 equivalent sem-cr-hrs in one domain. The student must also take at least 3 equivalent sem-cr-hrs in each of two additional domains. At least one of the ECE Technical Elective courses must be either a 5000-level semester course or a 700-level quarter course. The student must also take at least two ECE Technical Electives that are lab courses or courses with lab content. Semester courses in each of the domains are listed on the proposed semester advising sheets in Attachment #4. Quarter courses that would count in each of the domains are listed on the current advising sheets in Attachment #3 (called areas of concentration on the quarter advising sheet).

#### ECE and CSE Technical Electives – CES Program – Semester Requirements

CES students who elect to meet semester requirements must take at least 9 equivalent sem-cr-hrs of Technical Electives from a pick list of ECE and CSE courses. (This leaves up to 11 equivalent sem-cr-hrs of Directed Electives outside ECE.) See the proposed semester advising sheet in Attachment #4 for the pick list. Quarter courses that are comparable to those on the semester pick list may be used. At least one of the courses selected from the pick list must be either a 5000-level semester course, or 700-level comparable quarter course.

#### **Transfer Student Residency**

The transition policy for the residency requirement for transfer students is a direct conversion calculation. For transfer students that elect to meet quarter requirements, at least 45 equivalent qtr-cr-hrs must be ECE or CSE courses taken at OSU. For transfer students that elect to meet semester requirements, at least 30 equivalent sem-cr-hrs must be ECE or CSE courses taken at OSU. Classes taken under senior petition may be included for the residency requirement.

### **Transition Worksheets**

The ECE Undergraduate Studies Committee is developing Microsoft Excel-based worksheets for each of the four sets or transition principles above. The worksheets are being developed to allow students to work with academic advisors to assess election of quarters or semesters requirements and to develop a plan for timely progress toward degree. We also plan to make these worksheets available to students through the ECE web site to allow them to evaluate the possibilities prior to meeting with their academic advisor. The worksheets are planned to be interactive, so that as students check off the quarters courses already taken and those they plan to complete prior to the transition to semesters, the semesters requirements that have been met and the semesters course that need to be taken to complete the program will be displayed.

### **Course Sequences**

Required sequences of courses are one of the significant challenges in managing the transition. We will use two approaches to managing this.

First, through academic advising we will encourage students who have met prerequisites to start sequences early enough that they can complete them prior to the transition to semesters, and to not start quarters sequences that they cannot complete under quarters – except when it impedes their timely progress to degree.

Second, we expect to offer “transition” courses for students who do get caught part way through a quarters sequence that does not properly map into a semesters course or courses. For example, if an ECE-EES student completes ECE 331 but not ECE 432 prior to the transition to semesters they will be required to take a temporarily offered 2 sem-cr-hr “transition” course probably offered with a decimalized version of the related semesters course (for example 3030.01). Since the subject matter of ECE 432 largely matches with the final 2/3s of proposed ECE 3030 we do not expect to offer this transition course as a separate lecture. Rather, students who need this transition course will be required to attend the last 10 weeks of ECE 3030. This will require coordination of enrollment between the two course numbers, and planning of exams and assignments by the instructor, but we expect it to be manageable.

The proposed integrated sophomore experience deserves additional discussion, since it replaces four current lecture courses (ECE 205, 261, 301 and 351) and two current laboratory courses (ECE 206 and 209) with a two-semester sequence (ECE 2000 and 2100) in which laboratory experiments are integrated with the lectures. This sophomore experience is being piloted during the 2010-2011 academic year with a sequence of three ECE 294 group studies courses (294.01 in Au’10, 294.02 in Wi’11, and 294.03 in Sp’11) and a group of students who volunteered to take pilot in place of the regular set of courses. We plan to expand the pilot during the 2011-2012 academic year to all students entering the ECE major. Since the three-quarter-sequence of pilot courses directly maps into the two-semester integrated sophomore experience courses this will mitigate the need to offer “transition” versions of quarters courses ECE 205, 261, 301, 351, 206 and 209 after the change to semesters. For students who have already completed one or more of these quarters courses as of Spring 2011 we have worked out an advising plan, shown

in Figure 13-1, for the combinations of current quarters courses, sophomore experience pilot courses and a 1 qtr-cr-hour transition lab course that will allow the students to complete the sequence during the 2011-2012 academic year. In four cases two options are shown. The rows marked with yellow background and note 1 direct the student into the pilot. The rows marked with green background and notes 2 or 3 allow the student to complete the sequence one quarter sooner by using current quarter courses to satisfy requirements.

Courses finished as of SP'11						Taking next available course as early as possible							Notes				
261	206	205	351	301	209	AU'11		WI'12		SP'12							
						206	205	351	301	209	FPGA bridge lab	294.01	209	294.02	294.03		
X											X			X		1	
							X				X		X	X		2	
X	X										X			X	X		1
							X				X		X	X		2	
		X									X	X	X	X			
X		X									X		X	X		1	
X	X	X									X		X	X		3	
		X	X					X	X			X					
X	X	X						X	X								
		X						X	X			X					
X	X	X						X	X								
		X						X	X			X					
X	X	X						X	X								
		X	X					X	X			X					
X	X	X						X	X								
		X	X					X	X			X					
X		X	X					X	X								

1. Moves student into pilot, but they get done with sophomore courses later
2. Assumes student doesn't want to wait for 294.03
3. Assumes student doesn't want to wait for 294.02

**Figure 13-1:** Transition plan for the 2011-2012 academic year for students who have already completed one or more current quarter courses being replaced by the integrated sophomore experience course.

For students who start the integrated sophomore experience via the pilot courses in winter or spring of 2012, “transition” versions of portions of ECE 2000 and 2100, similar to the example above for ECE 331/432 and ECE 3030, will be used to allow them to complete the sequence after the change to semesters.

### Students’ Transition Plans

Unusual situations for particular students are likely to arise. Such situations will be handled on a case-by-case basis. The student, the ECE academic advisors, and if necessary the ECE Undergraduate Studies Committee will negotiate custom arrangements to allow the student to meet requirements, but program requirements must

be met. Accreditation issues might arise if students are allowed to graduate without meeting ECE program requirements. Students who find their progress to graduation impeded by *failure to meet with an academic advisor and complete their transition worksheet on a timely basis, by failing to follow their transition plan, or by earning a failing grade in any course*, may find themselves with little recourse. The student's transition plan, developed with an academic advisor, will include a clear statement identifying whether the student has elected to meet quarters or semesters requirements, which quarter and semester courses will be taken to meet the requirements, and a transition scheduling plan for when courses are to be taken so that their progress to degree is not impeded by the transition to semesters. The students will be asked to sign their personalized transition plan in the presence of an academic advisor. We expect that these meetings will start in Spring 2011.

#### **14. Assessment Practices**

We have implemented a carefully developed assessment plan, the basics of which we have used for more than a decade. Details of the plan are being submitted via the assessment plan survey form as discussed in Section 15. We expect that all essential components of the plan will be carried forward to the new program as we switch to semesters. Changes to the plan that may occur between now and then will be in response to things learned through the assessment process or from ABET and are not driven by the change to semesters.

#### **15. Assessment Plan on File with OAA**

The on-line assessment plan has been started and we expect to submit it to our curricular Dean for final submission to OAA by the start of autumn quarter 2010.

## Attachment #1: BSECE Proposed Requirements – Electrical Engineering Specialization

General Education	Course Number	Cr-hrs
Writing Level 1		3
Writing Level 2		3
Literature		3
Arts		3
Historical Study		3
Social Science 1		3
Social Science 2		3
Culture & Ideas or Historical Study		3
Total Liberal Arts Portion of Gen Ed		24

Engineering Core	Course Number	Cr-hrs
Engineering Survey	Engineering 1100	1
Fundamentals of Engineering	Engineering 1181	2
Fundamentals of Engineering	Engineering 1182	2
Engineering Calculus I	Math 1151	5
Engineering Calculus II	Math 1172	5
Physics I	Physics 1131	5
Total Engineering Core		20

ECE-EES Core	Course Number	Cr-hrs
Chemistry for Engineers	Chem ____	4
Intro to Computer Programming in C++ for Engineers & Scientists	CSE 1222	3
Physics II	Physics 1132	5
Differential Equations (with complex math)	Math 2415	3
Linear Algebra	Math 2568	3
Electrical and Computer Engineering I	ECE 2000	4
Electrical and Computer Engineering II	ECE 2100	4
Introduction to Microcontroller-Based Systems	ECE 2560	2
Introduction to RF and Optical Engineering	ECE 3010	3
Introduction to Electronics	ECE 3020	3
Semiconductor Electronic Devices	ECE 3030	3
Sustainable Energy and Power Systems I	ECE 3040	3
Signals and Systems	ECE 3050	3
Introduction to Probability and Statistics for Engineers	Statistics 4278	3
Engineering Economics	ISE 3040	2
Ethics and Professionalism	ECE 3080	1
Technical Communications	ECE 3090*	1
Capstone Design	ECE 4900	3
Total ECE-EES Core		53

Electives	Course Number	Cr-hrs
ECE Technical Electives		16
ECE Technical Electives or Directed Electives		15
Total Electives		31

Grand Total 128

\* We have initiated discussions with the Department of English on the possibility of their offering a 1 credit hour Technical Communications course for ECE majors.

## Attachment #2: BSECE Proposed Requirements – Computer Engineering Specialization

General Education	Course Number	Cr-hrs
Writing Level 1		3
Writing Level 2		3
Literature		3
Arts		3
Historical Study		3
Social Science 1		3
Social Science 2		3
Culture & Ideas or Historical Study		3
Total Liberal Arts Portion of Gen Ed		24

Engineering Core	Course Number	Cr-hrs
Engineering Survey	Engineering 1100	1
Fundamentals of Engineering	Engineering 1181	2
Fundamentals of Engineering	Engineering 1182	2
Engineering Calculus I	Math 1151	5
Engineering Calculus II	Math 1172	5
Physics I	Physics 1131	5
Total Engineering Core		20

ECE-CES Core	Course Number	Cr-hrs
Chemistry for Engineers	Chem _____	4
Intro to Computer Programming in C++ for Engineers & Scientists	CSE 1222	3
Physics II	Physics 1132	5
Differential Equations (with complex math)	Math 2415	3
Linear Algebra	Math 2568	3
Electrical and Computer Engineering I	ECE 2000	4
Electrical and Computer Engineering II	ECE 2100	4
Introduction to Microcontroller-Based Systems	ECE 2560	2
Software I: Software Components	CSE 2221	4
Software II: Software Development and Design	CSE 2231	4
Advanced C Programming	CSE 2451	2
Introduction to Electronics	ECE 3020	3
Advanced Digital Design	ECE 3367	3
Microcontroller Lab	ECE 3567	1
Computer Architecture and Design	ECE 5362	3
Discrete Math or Foundations I: Discrete Structures	Math 3366 or CSE 2321	3
System II: Introduction to Operating Systems	CSE 2431	3
Introduction to Probability and Statistics for Engineers	Statistics 4278	3
Engineering Economics	ISE 3040	2
Ethics and Professionalism	ECE 3080	1
Technical Communications	ECE 3090 <sup>†</sup>	1
Capstone Design	ECE 4900	3
Total ECE-EES Core		64

Electives	Course Number	Cr-hrs
ECE/CSE Technical Electives		9
ECE/CSE Technical Electives or Directed Electives		11
Total Electives		20

Grand Total	128
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<sup>†</sup> We have initiated discussions with the Department of English on the possibility of their offering a 1 credit hour Technical Communications course for ECE majors.

## **Attachment #3: Current BSECE advising sheets**

The current advising sheets for the Electrical Engineering Specialization and Computer Engineering Specialization are shown on the next two pages.

Name: \_\_\_\_\_ ID: \_\_\_\_\_ New to OSU: \_\_\_\_\_

email: \_\_\_\_\_ @ osu.edu Phone number: \_\_\_\_\_

http://www.ece.osu.edu

CORE (106 HRS)	AU	WI	SP
<i>Math</i> 151.0x 5	<i>Math</i> 152.0x 5	<i>Math</i> 153.0x 5	
<i>Chemistry</i> 121 5	<i>Physics</i> 131 5	<i>Physics</i> 132 5	
<i>Eng</i> 181 3	<i>Eng</i> 183 3	<i>En Graph 167 or CSE 202</i> 4	
<b>Yr. 1</b>			
<i>Math</i> 254 5	<i>Math</i> 415 4	<i>Math 571<sup>†</sup> or</i> 568 3	
<i>Physics</i> 133 5	<i>ECE</i> 205 3	<i>ECE</i> 209 2	
<i>ECE</i> 261 3	<i>ECE</i> 206 1	<i>ECE</i> 301 3	
	<i>ECE</i> 265 3	<i>ECE</i> 341 3	
<b>Yr. 2</b>			
<i>Stat 427 or Math</i> 530 3	<i>ECE</i> 311 3	<i>ECE</i> 312 3	
<i>ECE</i> 323 3	<i>ECE</i> 331 3	<i>ECE</i> 432 3	
<i>ECE</i> 351 3	<i>ECE</i> 352 3		
<b>Yr. 3</b>			
<i>ECE</i> 481 1	<i>Ind Eng</i> 504 3	<i>ECE 682 or</i> 683 3	
<b>Yr. 4</b>			

**GEN ED CURRICLM (38 HRS)**

**PRE-ADMISSION CONDITION**  
 \_\_\_\_\_ Met

One GEC must be a SOCIAL DIVERSITY course.

One GEC must be an ETHICS course. SS  or AH

**English & Comm Skills (13)**  
 English 110 \_\_\_\_\_ 5  
 2\*\* Wing Cts \_\_\_\_\_ 5  
 ECE 582 \_\_\_\_\_ 3

Students must take 25 hours across Social Sciences, Historical Study, and Arts & Humanities with a minimum of 5 hours and maximum of 10 hours per category.

**Social Sciences (5-10 hrs)**  
 \_\_\_\_\_ ( )  
 \_\_\_\_\_ ( )

**Historical Study (5-10 hrs)**  
 \_\_\_\_\_ ( )  
 \_\_\_\_\_ ( )

**Arts & Humanities (5-10 hrs)**  
 \_\_\_\_\_ ( )  
 \_\_\_\_\_ ( )

**TECHNICAL ELECTIVES AND SELECTED CORE: 52 HOURS TOTAL**

**TECHNICAL ELECTIVES**

- At least 37 hours of Technical Electives must be ECE (leaves up to 15 hours outside ECE, including "Selected Core" list at right); and
- Must take a concentration of 11 hours in one of the areas below (must include at least one 700-level course); and
- Must take either: A second concentration of 11 hours in another of the below areas (with at least one 700-level course), or additional concentrations of five hours in each of two areas; and
- At least 7 hours of technical electives must be ECE labs.

**OTHER TECH ELECTIVES**

COMM/DSP	ELECTROMGNTCS	MICROELCTRNCs AND PHOTONICS	CIRCUITS
Lectures	Lectures	Lectures	Lectures
ECE 501 3	ECE 613 3	ECE 632 3	ECE 620 3
ECE 600 3	ECE 614 3	ECE 730 3	ECE 624 3
ECE 650 <sup>†</sup> 3	ECE 710 4	ECE 694.02 3	ECE 694.02 3
ECE 675 3	ECE 711 3	ECE 731 3	ECE 694.04 3
ECE 700 3	ECE 713 3	ECE 732 3	ECE 720 3
ECE 702 3	ECE 714 3	ECE 734 3	ECE 721 3
ECE 706 3	ECE 715 3	ECE 735 3	ECE 722 3
ECE 707 3	ECE 716 3	ECE 736 3	ECE 724 3
ECE 779 3	ECE 717 3	Labs	Labs
Labs	ECE 719 3	ECE 637* 4	ECE 327 2
ECE 508 2	Labs	ECE 737* 4	ECE 628 2
ECE 609 2	ECE 517 2	TOTAL ( )	ECE 723* 4
TOTAL ( )	TOTAL ( )	TOTAL ( )	TOTAL ( )

**POWER**

Lectures	CONTROL
ECE 640 3	ECE 551 3
ECE 643 3	ECE 650 <sup>†</sup> 3
ECE 694.01 3	ECE 750 3
ECE 740 3	ECE 752 3
ECE 741 3	ECE 753.01 4
ECE 743 3	ECE 753.02 3
ECE 776.01 4	ECE 754 3
ECE 776.02 4	ECE 755 3
ECE 776.03 1	ECE 759 3
Labs	Labs
ECE 447 2	ECE 557 2
ECE 647 2	ECE 757 3
ECE 747* 4	ECE 758 3
TOTAL ( )	TOTAL ( )

**COMPUTER**

Lectures
ECE 561 3
ECE 662 3
ECE 668 3
ECE 694A 3
ECE 694.03 3
ECE 761 3
ECE 762 3
ECE 763 3
ECE 764 3
ECE 765 3
ECE 766 3
ECE 767 3
ECE 769 3
Labs
ECE 567 2
ECE 667 3
TOTAL ( )

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**SELECTED CORE**

A minimum of 3 hours (maximum of 9 hours) MUST be from this list:  
 Bio 113 (5), Chem 122 (5) or 125 (4), Chem 231 or 251 (3), Earth Sci 121 (5), Math 512 (3), Math 513 (3), Math 514 (3), Math 366 (3), ME 250 (4) or CS&E 541 (3), CS&E 230 (4), ME 410 (4), ME 420 (4), ME 430 (4), MSE 401 or ME 500 (4)

Hours Req'd for Degree: \_\_\_\_\_

Earned Hours to Date: \_\_\_\_\_

Total Proposed Hours: \_\_\_\_\_

Final CPHR: \_\_\_\_\_ Final MGPA: \_\_\_\_\_

OK to Graduate? Yes No \_\_\_\_\_

Program Approved: \_\_\_\_\_

Advisors Signature \_\_\_\_\_ Date \_\_\_\_\_

Transfer students:  
 45 ECE hrs?   
 Math & B. Science: 48 hrs?

Name: \_\_\_\_\_ ID: \_\_\_\_\_ New to OSU: \_\_\_\_\_

email: \_\_\_\_\_ osu.edu Phone number: \_\_\_\_\_

http://www.ece.osu.edu

CORE (125 HRS)		AU <b>Bold courses are included in SPHR</b>		WI		SP	
<i>Math</i>	151.0x 5	<i>Math</i>	152.0x 5	<i>Math</i>	153.0x 5		
<i>Chemistry</i>	121 5	<i>Physics</i>	131 5	<i>Physics</i>	132 5		
<i>Eng</i>	181 3	<i>Eng</i>	183 3	<i>CS&amp;E</i>	221* 4		
		<i>En Graph 167 or CS&amp;E 202*</i>	4	<i>Math</i>	366 3		
* EnGraph 167 or CS&E 202 or satisfactory placement exam score required as prereq for CS&E 221. NOTE: CS&E 221 is not included in SPHR if EnGraph 167 (or its equiv) was taken for a grade.							
Yr. 1							
<i>Math</i>	254 5	<i>Math</i>	415 4	<i>Math 571<sup>T</sup> or</i>	568 3		
<i>Physics</i>	133 5	<i>ECE</i>	205 3	<i>ECE</i>	206 1		
<i>CS&amp;E</i>	222 4	<i>ECE</i>	261 3	<i>ECE</i>	209 2		
		<i>CS&amp;E</i>	321 4	<i>ECE</i>	265 3		
Yr. 2				<i>ECE</i>	301 3		
<i>Stat 427 or Math</i>	530 3	<i>ECE</i>	331 3	<i>ECE</i>	352 3		
<i>ECE</i>	323 3	<i>ECE</i>	351 3	<i>ECE</i>	662 3		
<i>ECE</i>	567 2	<i>ECE</i>	561 3	<i>CS&amp;E</i>	560 5		
Yr. 3				<i>ECE 682 or 683</i>	3		
<i>ECE</i>	481 1			<input type="checkbox"/> 683 Syllabus			
<i>CS&amp;E</i>	660 3						
<i>Ind Eng</i>	504 3						
Yr. 4							

**GEN ED CURRICLM (36 HRS)**

**PRE-ADMISSION CONDITION**  
\_\_\_\_\_ Met

One GEC must be a SOCIAL DIVERSITY course.

One GEC must be an ETHICS course. SS  or AH

**English & Comm Skills (13)**  
English 110 \_\_\_\_\_ 5  
2\*\* Writ Crs \_\_\_\_\_  
\_\_\_\_\_ 5  
ECE 582 \_\_\_\_\_ 3

Students must take 25 hours across Social Sciences, Historical Study, and Arts & Humanities with a minimum of 5 hours and maximum of 10 hours per category.

**Social Sciences (5-10 hrs)**  
\_\_\_\_\_ ( ) \_\_\_\_\_  
\_\_\_\_\_ ( ) \_\_\_\_\_

**Historical Study (5-10 hrs)**  
\_\_\_\_\_ ( ) \_\_\_\_\_  
\_\_\_\_\_ ( ) \_\_\_\_\_

**Arts & Humanities (5-10 hrs)**  
\_\_\_\_\_ ( ) \_\_\_\_\_  
\_\_\_\_\_ ( ) \_\_\_\_\_

**TECHNICAL ELECTIVES AND SELECTED CORE: 33 HOURS TOTAL**

**TECHNICAL ELECTIVES**

Of the 24-33 Technical Elective hours:  
 12 hours must be selected from the list below; and  
 15 hours must be ECE, which includes Tech Elecs and EES core not in CES core (311, 312, 327, 341, 432, 447). ECE courses counted in the 12 hour requirement count in this requirement as well.

**VLSI (VERY LARGE SCALE INTEGRATED CIRCUITS) & COMPUTER-AIDED DESIGN** OTHER TECH ELECTIVES

ECE 720 (3) \_\_\_ ECE 721 (3) \_\_\_ CS&E 778 (4) \_\_\_

**MICROPROCESSOR BASED SYSTEMS**

ECE 765 (3) \_\_\_

**DIGITAL DESIGN AND COMPUTER ARCHITECTURE**

ECE 667 (3) \_\_\_ ECE 762 (3) \_\_\_ ECE 764 (3) \_\_\_ CS&E 775 (3) \_\_\_

**COMPUTER INTERFACING AND PROTOCOLS, COMPUTER NETWORKS**

ECE 766 (3) \_\_\_ CS&E 677 (3) \_\_\_

**ROBOTICS AND CONTROL FOR AUTOMATION**

ECE 551 (3) \_\_\_ ECE 755 (3) \_\_\_ ECE 757 (3) \_\_\_ ECE 763 (3) \_\_\_

**NEURAL NETWORKS, ARTIFICIAL INTELLIGENCE**

ECE 779 (3) \_\_\_ CS&E 630 (3) \_\_\_

**DIGITAL SIGNAL PROCESSING/IMAGE PROCESSING**

ECE 600 (3) \_\_\_ ECE 609 (2) \_\_\_ ECE 700 (3) \_\_\_ ECE 706 (3) \_\_\_  
ECE 707 (3) \_\_\_

**APPLIED SOFTWARE ENGINEERING**

ECE 668 (3) \_\_\_ ECE 767 (3) \_\_\_ ECE 769 (3) \_\_\_

**SEMICONDUCTORS**

ECE 637 (4) \_\_\_ ECE 730 (3) \_\_\_

**COMMUNICATION THEORY**

ECE 501 (3) \_\_\_ ECE 702 (3) \_\_\_

**NUMERICAL ANALYSIS**

ECE 759 (3) \_\_\_ CS&E 541 (3) \_\_\_

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**SELECTED CORE**

0-9 hours may be taken from this list:  
 Bio 113 (5), Chem 122 (5) or 125 (4),  
 Chem 231 or 251 (3), Earth Sci 121 (5),  
 ME 250 (4), ME 410 (4), ME 420 (4),  
 ME 430 (4), MSE 401 or ME 500 (4)

Total from list ( )  
 Total Other TEs ( )  
 Total Selec Core ( )

**TOTAL ( )**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Hours Req'd for Degree: \_\_\_\_\_

Earned Hours to Date: \_\_\_\_\_

Total Proposed Hours: \_\_\_\_\_

Final CPHR: \_\_\_\_\_ Final MGPA: \_\_\_\_\_

OK to Graduate? Yes No \_\_\_\_\_

Program Approved: \_\_\_\_\_

Transfer students:  
 45 ECE hrs?   
 Math & B. Science:  
 48 hrs?

Advisor's Signature \_\_\_\_\_ Date \_\_\_\_\_

## **Attachment #4: Proposed BSECE advising sheets**

The proposed advising sheets for the Electrical Engineering Specialization and Computer Engineering Specialization are shown on the next two pages.

Name: \_\_\_\_\_ ID: \_\_\_\_\_ New to OSU: \_\_\_\_\_

email: \_\_\_\_\_@osu.edu Phone number: \_\_\_\_\_ http://www.ece.osu.edu

CORE (74 HRS)	AU	<i>Bold</i> courses are included in SPHR	SP
<b>Engr (Fund. Of Engr I)</b> 1181 2		<b>Engr (Fund. Of Engr II)</b> 1182 2	
<b>Math (Engr. Calculus I)</b> 1151 5		<b>Math (Engr. Calculus II)</b> 1172 5	
<b>Chemistry for Engineers</b> Sxxx 4		<b>Physics I</b> 1131 5	
Engr (Survey) 1100 1		<b>CSE (Programming C/C++)</b> 1222 3	
Yr. 1			
<b>Physics II</b> 1132 5		Math (DiffEq&CmplxMath) 2415 3	
Math (Linear Algebra) 2568 3		ECE (Intro to ECE II) 2100 4	
ECE (Intro to ECE I) 2000 4		ECE (Microcontrollers) 2560 2	
		ECE (2 <sup>nd</sup> Tier 1) 30x0 3	
Yr. 2			
ECE (2 <sup>nd</sup> Tier 2) 30x0 3		Stat (Prob&Stat) 4278 3	
ECE (2 <sup>nd</sup> Tier 3) 30x0 3		ECE (2 <sup>nd</sup> Tier 5) 30x0 3	
ECE (2 <sup>nd</sup> Tier 4) 30x0 3			
Yr. 3			
ISE 3040 2		ECE (Capstone Design) 4900 3	
ECE (Ethics & Prof.) 3080 1			
ECE (Tech. Writing) 3090 1			
Yr. 4			

General Education (24 HRS)
<b>PRE-ADMISSION CONDITION</b>
_____ Met <input type="checkbox"/>
<b>One GE must be a US Social Diversity Course.</b> <input type="checkbox"/>
<b>One GE must be an ETHICS course.</b> SS <input type="checkbox"/> or AH <input type="checkbox"/>
<b>English &amp; Comm Skills (6)</b>
English 110 successor 3 _____
367 successor 3 _____
Students must take 18 hours across Social Sciences, Historical Study, and Arts & Humanities with minimum and maximum hours per category as specified.
<b>Social Sciences (6-9 hrs)</b>
Cat A: 3 _____
Cat B: 3 _____
_____ 3 _____
<b>Historical Study (3-6 hrs)</b>
_____ 3 _____
_____ 3 _____
<b>Arts &amp; Humanities (6-9 hrs)</b>
Lit 3 _____
Arts 3 _____
_____ 3 _____

**ELECTIVES (31 HRS)**

- At least 16 hours of the Electives must be ECE Technical Electives.
  - Must take a concentration of 6 hours in one of the domains below.
  - Must take at least 3 hours in each of two other domains below.
  - Must include at least one 5000 level ECE Technical Elective.
  - At least two ECE Technical Elective courses must be labs.
- Up to 15 hours of the Electives may be Directed Electives from the ECE approved list. Directed Electives generally include: courses required for entry into other engineering majors; required and technical elective courses in other engineering majors; pre-med courses; business or entrepreneurship courses; math, statistics, physics and chemistry courses at higher level than required in the ECE core; and other physical science or biological science courses. For physical science or biological science courses a maximum of 7 hours numbered below 2000 may be counted as Directed Electives.

**ECE 2nd Tier**

*It is recommended that all five of these courses be completed by end of junior year to allow technical electives that rely on them to be taken senior year.*

COMM/DSP	COMPUTER	ELECTRONICS	ELECTROMAGNETICS	OTHER ELECTIVES
<b>Lectures</b>	<b>Lectures</b>	<b>Lectures</b>	<b>Lectures</b>	
ECE 5000 3 _____	ECE 5362 3 _____	ECE 5020 3 _____	ECE 5010 3 _____	
ECE 5101 3 _____	ECE 5460 3 _____	ECE 5021 3 _____	ECE 5011 3 _____	
ECE 5200 3 _____	ECE 5462 3 _____	ECE 5022 3 _____	ECE 5012 3 _____	
ECE 5206 3 _____	ECE 5463 3 _____	ECE 5120 3 _____	ECE 5510 3 _____	
ECE 5400 3 _____	ECE 5465 3 _____		ECE 5511 3 _____	
<b>Labs</b>	ECE 5468 3 _____	<b>Labs</b>		
ECE 4007 0.5 _____	<b>Labs</b>	ECE 3027 0.5 _____	<b>Labs</b>	
ECE 4207 0.5 _____	ECE 3367 3 _____	ECE 5027 4 _____	ECE 3017 0.5 _____	
<b>TOTAL ( )</b>	ECE 3567 1 _____	<b>TOTAL ( )</b>	ECE 5017 4 _____	
	<b>TOTAL ( )</b>		<b>TOTAL ( )</b>	

ECE 3010 3 _____	
(RF & Optical Engineering)	
ECE 3020 3 _____	
(Intro to Electronics)	
ECE 3030 3 _____	
(Semiconductor Electronic Devices)	
ECE 3040 3 _____	
(Sustainable Energy & Power Sys.1)	
ECE 3050 3 _____	
(Signals & Systems)	

**SOLID STATE ELECTRONICS & PHOTONICS**

<b>Lectures</b>
ECE 5031 3 _____
ECE 5033 3 _____
ECE 5131 3 _____
ECE 5132 3 _____
ECE 5530 3 _____
ECE 5531 3 _____
ECE 5532 3 _____
<b>Labs</b>
ECE 5037 4 _____
ECE 5137 0.5 _____
ECE 5237 3 _____
<b>TOTAL ( )</b>

**ENERGY & POWER**

<b>Lectures</b>
ECE 5025 3 _____
ECE 5041 3 _____
ECE 5042 3 _____
ECE 5541 3 _____
<b>Labs</b>
ECE 3047 1 _____
ECE 5047 3 _____
ECE 5127 1 _____
<b>TOTAL ( )</b>

**CONTROL**

<b>Lectures</b>
ECE 3551 3 _____
ECE 5551 3 _____
ECE 5553.013 _____
ECE 5553.023 _____
ECE 5750 3 _____
ECE 5754 3 _____
ECE 5759 3 _____
<b>Labs</b>
ECE 3557 1 _____
ECE 5557 1 _____
<b>TOTAL ( )</b>


Hours Req'd for Degree: _____	Transfer students: 30 OSU ECE hrs? <input type="checkbox"/>
Earned Hours to Date: _____	
Total Proposed Hours: _____	Math & B. Science: 32 hrs? <input type="checkbox"/>
<b>Final CPHR:</b> _____	<b>Final MGPA:</b> _____
<b>OK to Graduate?</b> Yes No _____	
Program Approved: _____	
Advisor's Signature _____	Date _____

Name: \_\_\_\_\_ ID: \_\_\_\_\_ New to OSU: \_\_\_\_\_

email: \_\_\_\_\_@osu.edu Phone number: \_\_\_\_\_

http://www.ece.osu.edu

CORE (85 HRS)	AU	<b>Bold</b> courses are included in SPHR	SP
<u>Engr (Fund. Of Engr I)</u>	1181	2	<u>Engr (Fund. Of Engr II)</u> 1182 2
<u>Math (Engr. Calculus I)</u>	1151	5	<u>Math Engr. (Calculus II)</u> 1172 5
<u>Chemistry</u>	Sxxx	4	<u>Physics (Mechanics +...)</u> 1131 5
<u>Engr (Survey)</u>	1100	1	<u>CSE (Programming C/C++)</u> 1222 3
Yr. 1			
<u>Physics (E&amp;M +...)</u>	1132	5	<u>Math 3366 or CSE 2321</u> _____ 3
<u>Math (Linear Algebra)</u>	2568	3	<u>ECE (Intro to ECE II)</u> 2100 4
<u>ECE (Intro to ECE I)</u>	2000	4	<u>ECE (Microcontrollers)</u> 2560 2
<u>CSE (Dev Software I)</u>	2221	4	<u>CSE (Dev Software II)</u> 2231 4
			<u>CSE (Adv. Prog. In C)</u> 2451 2
Yr. 2			
<u>Stat (Prob&amp;Stat)</u>	4278	3	<u>ECE (Comp. Arch. Design)</u> 5362 3
<u>ECE (Electronics)</u>	3020	3	<u>CSE (Sys II/OS)</u> 2431 3
<u>ECE (Adv. Digital Design)</u>	3367	3	
<u>Math(Diff Eq&amp;CmplxMath)</u>	2415	3	
<u>ECE (Microcontrollers Lab)</u>	3567	1	
Yr. 3			
<u>ISE</u>	3040	2	<u>ECE (Capstone Design)</u> 4900 3
<u>ECE (Ethics &amp; Prof.)</u>	3080	1	
<u>ECE (Tech. Writing)</u>	3090	1	
Yr. 4			

**ELECTIVES (20 HRS)**

- At least 9 hours of the Technical Electives must be ECE or CSE courses selected from the lists below.
- Must include at least one 5000 level ECE or CSE Technical Elective.
- Up to 11 hours of the Electives may be Directed Electives from the ECE approved list. Directed Electives generally include: courses required for entry into other engineering majors; required and technical elective courses in other engineering majors; pre-med courses, business or entrepreneurship courses; math, statistics, physics and chemistry courses at higher level than required in the ECE core; and other physical science or biological science courses. For physical science or biological science courses a maximum of 7 hours numbered below 2000 may be counted as Directed Electives.

**VLSI (Very Large Scale Integrated Circuits) & Computer Aided Design**  
ECE 5020 (3) \_\_\_\_\_

**Microprocessor Based Systems**  
ECE 5465 (3) \_\_\_\_\_

**Digital Design and Computer Architecture**  
ECE 5462 (3) \_\_\_\_\_ ECE 5468 (3) \_\_\_\_\_ CSE 3421 (3) \_\_\_\_\_

**Computer Networks**  
ECE 5101 (3) \_\_\_\_\_ CSE 3461 (3) \_\_\_\_\_

**Robotics and Control for Automation**  
ECE 3551 (3) \_\_\_\_\_ ECE 5463 (3) \_\_\_\_\_ ECE 5553.02 (3) \_\_\_\_\_

**Digital Signal Processing/Image Processing**  
ECE 5200 (3) \_\_\_\_\_ ECE 5206 (3) \_\_\_\_\_ ECE 5460

**Numerical Analysis**  
CSE 5361 (3) \_\_\_\_\_

**Database/Algorithms**  
CSE 3241 (3) \_\_\_\_\_ CSE 5242 (3) \_\_\_\_\_

**High Performance Computing**  
CSE 5441 (3) \_\_\_\_\_

**General Education (24 HRS)**

**PRE-ADMISSION CONDITION**  
\_\_\_\_\_ Met

**One GE must be a US Social Diversity Course.**

**One GE must be an ETHICS course.** SS  or AH

**English & Comm Skills (6)**

English 110 successor 3 \_\_\_\_\_  
367 successor 3 \_\_\_\_\_

Students must take 18 hours across Social Sciences, Historical Study, and Arts & Humanities with minimum and maximum hours per category as specified.

**Social Sciences (6-9 hrs)**

Cat A: \_\_\_\_\_ 3 \_\_\_\_\_  
Cat B: \_\_\_\_\_ 3 \_\_\_\_\_  
\_\_\_\_\_ 3 \_\_\_\_\_

**Historical Study (3-6 hrs)**

\_\_\_\_\_ 3 \_\_\_\_\_  
\_\_\_\_\_ 3 \_\_\_\_\_

**Arts & Humanities (6-9 hrs)**

Lit \_\_\_\_\_ 3 \_\_\_\_\_  
Arts \_\_\_\_\_ 3 \_\_\_\_\_  
\_\_\_\_\_ 3 \_\_\_\_\_

**OTHER ELECTIVES**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Total from list (\_\_\_\_)

Total Other Elecs (\_\_\_\_)

TOTAL (\_\_\_\_)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Hours Req'd for Degree: \_\_\_\_\_  
Earned Hours to Date: \_\_\_\_\_  
Total Proposed Hours: \_\_\_\_\_

Transfer students:  
30 OSU ECE hrs?   
Math & B. Science:  
32 hrs?

Final CPHR: \_\_\_\_\_ Final MGPA: \_\_\_\_\_

OK to Graduate? Yes No \_\_\_\_\_

Program Approved: \_\_\_\_\_

Advisor's Signature \_\_\_\_\_ Date \_\_\_\_\_

## Attachment #5: Curriculum Map for the Electrical Engineering Specialization

### Required Courses

Math, Physics and Chemistry course syllabi were not yet available in the syllabus tool used to generate this curriculum map. GE courses are expected to make significant contribution (\*\*\*) to Program Outcomes h and j.

### Electrical Engineering Curriculum Map: Courses to Program Outcomes

Course Number	a	b	c	d	e	f	g	h	i	j	k	l	m	n
ENGINEER 1181.01	***	**	*	**	***	*	**	*			***		*	*
ENGINEER 1182.01	**	**	***	**	**		**				***		*	*
CSE 1222	**	*	***		***		*		**		***	*	*	*
ECE 2000	***	***	***	***	***				*	**	***	***	***	***
ECE 2100	***	***	***	***	***				*	**	***	***	***	***
ECE 2560	***		***		**						***	***	**	**
ECE 3010	***				*				**			***	*	*
ECE 3020	*		*		***						*	***	**	
ECE 3030	***		*		**		*		*	*	*	***	*	*
ECE 3040	***	*	*		***	*		**	**	**	**	**	*	*
ECE 3050	***	*	*		***		*		*		***	***	**	**
ECE 3080			**			***		***		*				**
ECE 3090	**			*			***		*			*		*
ECE 4900	***	***	***	***	***	**	***	**	**		***	***	***	***
ISE 3040	*		*		**			**			***		*	*

### Key:

In the College of Engineering syllabus tool the choices for the contribution of a class to the Program Outcomes are:

- (Blank) No contribution
- \* Some contribution
- \*\* Substantial contribution
- \*\*\* Significant contribution

Attachment #6: Curriculum Map for the Computer Engineering Specialization

**Required Courses**

Math, Physics and Chemistry course syllabi were not yet available in the syllabus tool used to generate this curriculum map. GE courses are expected to make significant contribution (\*\*\*) to Program Outcomes h and j.

**Computer Engineering Curriculum Map: Courses to Program Outcomes**

Course Number	a	b	c	d	e	f	g	h	i	j	k	l	m	n
ENGINEER 1181.01	***	**	*	**	***	*	**	*			***		*	*
ENGINEER 1182.01	**	**	***	**	**		**				***		*	*
CSE 1222	**	*	***		***		*		**		***	***	*	*
CSE 2221	***	*	***		**		*		*		***	***	*	*
CSE 2231	***	*	***	**	**		*		*		***	***	*	*
CSE 2321	***		**		*				*		**	*	*	*
CSE 2431	**	**	**		***				*		***	***	*	*
CSE 2451	*	**	**		**						**	***	*	*
ECE 2000	***	***	***	***	***				*	**	***	***	***	***
ECE 2100	***	***	***	***	***				*	**	***	***	***	***
ECE 2560	***		***		**						***	***	**	**
ECE 3020	*		*		***						*	***	**	
ECE 3080			**			***		***		*				**
ECE 3090	**			*			***		*			*		*
ECE 3367	***	***	***	**	***	*	*		**		***	**	**	**
ECE 3567	***	***	***	***	***						***	***	*	
ECE 4900	***	***	***	***	***	**	***	**	**		***	***	***	***
ECE 5362	***		***								***	**	*	*
ISE 3040	*		*		**			**			***		*	*

**Key:**

In the College of Engineering syllabus tool the choices for the contribution of a class to the Program Outcomes are:

- (Blank) No contribution
- \* Some contribution
- \*\* Substantial contribution
- \*\*\* Significant contribution

## Attachment #7: Transition Principles – concise form with equations

Definition of variables:

$S$	= semester credit hours
$Q$	= quarter credit hours
$S_{MBS}$	= semester credit hours in a course that counts toward the ABET math and basic science requirement
$Q_{MBS}$	= quarter credit hours in a course that counts toward the ABET math and basic science requirement
$S_{SC}$	= semester credit hours in semesters courses comparable to Selected Core pick list (a quarters program list) courses
$Q_{SC}$	= quarter credit hours in a course from the Selected core pick list
$S_{ECETE}$	= semester credit hours in ECE Technical Elective courses
$Q_{ECETE}$	= quarter credit hours in ECE Technical Elective courses
$S_{ECETELAB}$	= semester lab credit hours in ECE Technical Elective courses
$Q_{ECETELAB}$	= quarter lab credit hours in ECE Technical Elective courses
$S_{ECE\&CSETE}$	= semester credit hours in ECE and CSE Technical Elective courses from the CES pick list
$Q_{ECE\&CSETE}$	= quarter credit hours in ECE and CSE Technical Elective courses from the CES pick list
$S_{ECE\&CSE}$	= semester credit hours in an ECE or CSE course
$Q_{ECE\&CSE}$	= quarter credit hours in an ECE or CSE course
$S_{GE}$	= semester credit hours in a General Education course
$Q_{GEC}$	= quarter credit hours in a GEC course

## Transition Principles – Quarters Requirements – EES

**Total hours to degree:**  $1.5S + Q \geq 196$

**GEC:** The category requirements of the student's GEC must be met

**Math and Basic Science hours (ABET):**  $1.5S_{MBS} + Q_{MBS} \geq 48$

### Selected Core:

- $1.5S_{SC} + Q_{SC} \geq 3$
- Allow  $1.5S_{SC} + Q_{SC} \leq 6$  *additional* hours from Selected Core pick list or semesters course topics comparable to Selected Core pick list courses. Credits here count against Outside Technical Electives.

### ECE Technical Electives

- Total ECE TE:  $1.5S_{ECETE} + Q_{ECETE} \geq 37$
- Area of concentration:  $1.5S_{ECETE} + Q_{ECETE} \geq 11$ , with at least one 700-level quarters course or 5000-level semesters course.
- Additional area(s) of concentration
  - A second area of concentration:  $1.5S_{ECETE} + Q_{ECETE} \geq 11$ , with at least one 700-level quarters course or 5000-level semesters course.
  - Or two additional areas of concentration:  $1.5S_{ECETE} + Q_{ECETE} \geq 5$
- Labs:  $1.5S_{ECETELAB} + Q_{ECETELAB} \geq 7$  (may also count toward areas of concentration)

### ECE EES Core:

- Use a mapping of semesters courses onto quarters requirements to assign credit for meeting specific course requirements
- No overall credit hour requirement
- Credit mismatches in Math and Basic Sciences
  - Must still meet minimum stated above
  - Overages count toward technical elective requirement in the Outside Technical Elective category
- Credit mismatches in ECE courses handled by adding to/subtracting from ECE Technical Electives
- Credit mismatches in non-ECE/non-MBS handled by adding to/subtracting from Outside Technical Electives

### Transfer Students Residency:

- $1.5S_{ECE\&CSE} + Q_{ECE\&CSE} \geq 45$
- Senior petition classes may be included

## Transition Principles – Quarters Requirements – CES

**Total hours to degree:**  $1.5S + Q \geq 196$

**GEC:** The category requirements of the student's GEC must be met

**Math and Basic Science hours (ABET):**  $1.5S_{MBS} + Q_{MBS} \geq 48$

### Selected Core:

- Allow  $1.5S_{SC} + Q_{SC} \leq 9$  hours from Selected Core pick list or semesters course topics comparable to Selected Core pick list courses. Credits here count against Outside Technical Electives.

### ECE Technical Electives

- Total ECE TE:  $1.5S_{ECETE} + Q_{ECETE} \geq 15$
- CES pick list:  $1.5S_{ECETE} + Q_{ECETE} \geq 12$  from the pick list of ECE & CSE courses.
  - Semesters courses available to undergraduates comparable to those on the quarters ECE-CES bingo sheet may be used.
  - ECE courses used to meet this requirement also count toward the 15 hour ECE TE requirement.

### ECE CES Core:

- Use a mapping of semesters courses onto quarters requirements to assign credit for meeting specific course requirements
- No overall credit hour requirement
- Credit mismatches in Math and Basic Sciences
  - Must still meet minimum stated above
  - Overages count toward technical elective requirement in the Outside Technical Elective category
- Credit mismatches in ECE courses handled by adding to/subtracting from ECE Technical Electives
- Credit mismatches in non-ECE/non-MBS handled by adding to/subtracting from Outside Technical Electives

### Transfer Students Residency:

- $1.5S_{ECE\&CSE} + Q_{ECE\&CSE} \geq 45$
- Senior petition classes may be included

## Transition Principles – Semesters Requirements – EES

**Total hours to degree:**  $S + (2/3)Q \geq 128$

### General Education/GEC

- For students accepted into the College of Engineering prior to the start of semesters the seven liberal arts category requirements of the student's GEC must be met.
- For students accepted into the college of Engineering after the start of semesters the eight liberal arts semesters Engineering General Education category requirements must be met. Excess credit hours resulting from the combination of semesters and quarters courses taken to meet these General Education category requirements,  $[S_{GE} + (2/3)Q_{GEC}] - 24$ , count against Directed Electives

**Math and Basic Science hours (ABET):**  $S_{MBS} + (2/3)Q_{MBS} \geq 32$

**Selected Core:** Quarters selected core courses taken that would have met quarters ECE-EES requirements but do not meet semesters ECE-EES Core requirements count against Directed Electives.

### ECE Technical Electives

- Total ECE TE:  $S_{ECETE} + (2/3)Q_{ECETE} \geq 16$ 
  - ECE TE Domain 1:  $S_{ECETE} + (2/3)Q_{ECETE} \geq 6$
  - ECE TE Domain 2:  $S_{ECETE} + (2/3)Q_{ECETE} \geq 3$
  - ECE TE Domain 3:  $S_{ECETE} + (2/3)Q_{ECETE} \geq 3$
- At least one 5000-level semesters course or 700-level quarters course.
- Labs: Two ECE technical electives that are lab courses or courses with lab content

### ECE EES Core:

- Use a mapping of quarter courses onto semester requirements to assign credit for meeting specific course requirements
- No overall credit hour requirement
- Credit mismatches in Math and Basic Sciences
  - Must still meet minimum stated above
  - Overages count toward electives in Directed Elective category
- Credit mismatches in ECE courses handled by adding to/subtracting from ECE Technical Electives
- Credit mismatches in non-ECE/non-MBS handled by adding to/subtracting from Directed Electives

### Transfer Students Residency:

- $S_{ECE\&CSE} + (2/3)Q_{ECE\&CSE} \geq 30$
- Senior petition classes may be included

## Transition Principles – Semesters Requirements – CES

**Total hours to degree:**  $S + (2/3)Q \geq 128$

### General Education/GEC

- For students accepted into the College of Engineering prior to the start of semesters the seven liberal arts category requirements of the student's GEC must be met.
- For students accepted into the college of Engineering after the start of semesters the eight liberal arts semesters Engineering General Education category requirements must be met. Excess credit hours resulting from the combination of semesters and quarters courses taken to meet the eight General Education category requirements,  $[S_{GE} + (2/3)Q_{GEC}] - 24$ , count against Directed Electives

**Math and Basic Science hours (ABET):**  $S_{MBS} + (2/3)Q_{MBS} \geq 32$

**Selected Core:** Quarters selected core courses taken that would have met quarters ECE-CES requirements but do not meet semesters ECE-CES Core requirements count against Directed Electives.

### ECE Technical Electives

- CES pick list:  $S_{ECE\&CSE\&TE} + (2/3)Q_{ECE\&CSE\&TE} \geq 9$  from the pick list of ECE & CSE courses on the semesters ECE-CES bingo sheet.
- Quarters courses comparable to the those on the semesters ECE-CES bingo sheet may be used.
- At least one 5000-level semesters course or 700-level quarters course.

### ECE CES Core:

- Use a mapping of quarter courses onto semester requirements to assign credit for meeting specific course requirements
- Will need to look at course-by-course
- No overall credit hour requirement
- Credit mismatches in Math and Basic Sciences
  - Must still meet minimum stated above
  - Overages count toward electives in the Directed Elective category
- Credit mismatches in ECE and CSE courses handled by adding to/subtracting from ECE-CSE TE
- Credit mismatches in non-ECE-CSE/non-MBS handled by adding to/subtracting from Directed Electives

### Transfer Students Residency:

- $S_{ECE\&CSE} + (2/3)Q_{ECE\&CSE} \geq 30$
- Senior petition classes may be included