## Bachelor of Science in Electrical Engineering

### Freshman Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>ENGR 1130 Chemistry for Engineers</td>
<td>5 PHYS 2311/2321 General Physics I &amp; Lab 5</td>
</tr>
<tr>
<td>ELEC 1201†† Intro. to Electrical Engr.</td>
<td>1 ELEC 1520 Embedded Systems Engr. I 3</td>
</tr>
<tr>
<td>ELEC 1510 Logic Design</td>
<td>3 ELEC 2531 Logic Laboratory 1</td>
</tr>
<tr>
<td>ENGL 1020 Core Composition I</td>
<td>3 Core Curriculum Course (see sec. X) 3</td>
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### Sophomore Year

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<tr>
<th>Fall</th>
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<tbody>
<tr>
<td>MATH 2421 Cal. &amp; Anal. Geo. III</td>
<td>4 ELEC 2142 Circuits Analysis II 3</td>
</tr>
<tr>
<td>MATH 3195 Linear Alg. &amp; Diff. Eq.</td>
<td>4 ELEC 2552 Sophomore. Circuits Lab. 1</td>
</tr>
<tr>
<td>PHYS 2331 Gen. Physics II</td>
<td>4 ELEC 2520 Embedded Systems Engr. II 3</td>
</tr>
<tr>
<td>ELEC 2132 Circuits Analysis I</td>
<td>3 Core Curriculum Course (see sec. X) 3</td>
</tr>
<tr>
<td>ENGL 2030 Core Composition II</td>
<td>3 Core Curriculum Course (see sec. X) 3</td>
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### Junior Year

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<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>ELEC 3133 Electromagnetic Fields</td>
<td>3 ELEC 3164 Energy Conversion 3</td>
</tr>
<tr>
<td>ELEC 3215 Electronics I</td>
<td>3 ELEC 3225 Electronics II 3</td>
</tr>
<tr>
<td>ELEC 3316 Linear Systems</td>
<td>3 ELEC 3735 Junior Lab 1</td>
</tr>
<tr>
<td>ELEC 3715 Electronics Lab</td>
<td>1 ELEC 3724 Energy Conversion Lab 1</td>
</tr>
<tr>
<td>ELEC 3651 Digital Hardware Design</td>
<td>3 ELEC 3817 Engr. Probability &amp; Stats 3</td>
</tr>
<tr>
<td>ENGR 3400 Technology and Culture</td>
<td>3 Professional Elective (see sec. IX) 3</td>
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### Senior Year

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<tr>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>ELEC 4309 Senior Design Project I</td>
<td>3 ELEC 4319 Senior Design Project II 3</td>
</tr>
<tr>
<td>ENGR Science Elective</td>
<td>3 Core Curriculum Course (see sec. X) 3</td>
</tr>
<tr>
<td>ELEC Specialty (see sec. VIII)</td>
<td>3 ELEC Specialty &amp; Lab (see sec. VIII) 4</td>
</tr>
<tr>
<td>ELEC Specialty (see sec. VIII)</td>
<td>3 ELEC Specialty (see sec. VIII) 3</td>
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<tr>
<td>ELEC Specialty &amp; Lab (see sec. VIII)</td>
<td>4 Professional Elective (see sec. IX) 3</td>
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† Transfer students who have not had ELEC 2132 (Circuits I), or equivalent, prior to transfer are required to take ELEC 1201 prior to, or concurrent with ELEC 2132. Transfer students who have taken ELEC 2132, or equivalent, and have not yet taken ELEC 1201, or equivalent, are not eligible to take ELEC 1201 and must take 1 credit hour of ENGR 4150 for a letter grade instead.

†† ELEC 1201 will be offered in the Fall semesters only.
BSEE Curriculum: **Effective Fall 2017**
Each Student MUST follow the rules of the ELEC Department as outlined.

### I Intellectual Competencies (6 semester hours) (see p. 4)
Competency is satisfied by a letter grade of C- or higher. Pass/fail is not allowed. Complete all of the following:
- ENGL 1020 - Core Composition I
- ENGL 2030 - Core Composition II

### II Common Core Courses (18 semester hours) (see p. 4)

**SOCIAL SCIENCES:** one course  
**BEHAVIORAL SCIENCES:** one course  
**HUMANITIES:** one course  
**ARTS:** one course  
**CULTURAL DIVERSITY:** one course  
**INTERNATIONAL PERSPECTIVES:** one course

### III Mathematics (19 semester hours)
- MATH 1401-4  Analytical Geometry and Calculus I
- MATH 2411-4  Analytical Geometry and Calculus II
- MATH 2421-4  Calculus and Analytical Geometry III
- MATH 3195-4  Linear Algebra & Differential Equations (MATH 3191 and MATH 3200 taken together can substitute MATH 3195)
- ELEC 3817-3  Engineering Probability & Statistics

### IV Basic Science (14 semester hours)
- PHYS 2311-4  General Physics I
- PHYS 2321-1  General Physics Lab I
- PHYS 2331-4  General Physics II
- ENGR 1130-5  Engineering General Chemistry  
  or CHEM 1130-5  Engineering General Chemistry (if taken prior to Spring of 2017)

### V Engineering Science Elective (3 semester hours)
- MECH 3012-3  Thermodynamics

Or approved Engineering Science special topics course such as: Quantum Electronics (ELEC 4678) and Renewable Energy (ELEC 4755).

### VI Electrical Engineering Required Courses (39 semester hours)
- ELEC 1201-1  Introduction to Electrical Engineering†
- ELEC 1510-3  Logic Design
- ELEC 1520-3  Embedded Systems I
- ELEC 2132-3  Circuit Analysis I
- ELEC 2142-3  Circuit Analysis II
- ELEC 2520-3  Embedded Systems II
- ELEC 2531-1  Logic Laboratory
- ELEC 2552-1  Sophomore Circuits Laboratory

- ELEC 3133-3  Electromagnetic Fields
- ELEC 3164-3  Energy Conversion
- ELEC 3215-3  Electronics I
- ELEC 3225-3  Electronics II
- ELEC 3316-3  Linear Systems
- ELEC 3651-3  Digital Hardware Design
- ELEC 3715-1  Electronics Laboratory
- ELEC 3724-1  Energy Conversion Lab
- ELEC 3735-1  Junior Laboratory

### VII Electrical Engineering Required Senior Design Sequence (6 Semester Hours)
- ELEC 4309-3  Senior Design Project I
- ELEC 4319-3  Senior Design Project II
ELEC Elective and Specialty Courses in Association with Design Laboratory (17 semester hours):

Students are required to take at least two (2) laboratories out of the following six (6) groups. Students are required to take five ELEC specialty elective courses, two of which should match (be in the same group) two laboratory courses. These courses will be staggered, and will not be offered every semester. Depending on the enrollment, the laboratory courses may be offered more frequently. The “Theory Component” (without the laboratory) may be taken as the “Specialty” courses. Additionally, ELEC graduate level courses have been approved as “Specialty” courses. In all cases, “Specialty” courses must be ELEC courses at the four thousand level or higher. These classes typically may not be transferred in from other institutions. Any requests for exception to this must be petitioned (see section XI, part 6). All students must take at least one ELEC specialty class from three of the following (6) areas.

Communications and Signal Processing
ELEC 4247-3 Communication Theory
ELEC 4248-3 Digital Communication Systems
ELEC 4467-1 Communications Laboratory

Controls and Signal Processing
ELEC 4136-3 Control Systems Analysis
ELEC 4276-3 Digital Control Systems
ELEC 4466-3 Adaptive Control System Design
ELEC 4406-1 Control Systems Laboratory

Microelectronics and VLSI
ELEC 4005-3 IC Design
ELEC 4025-3 Device Electronics
ELEC 4225-3 Electronics III
ELEC 4555-3 VLSI Circuit Simulation
ELEC 4435-1 Advanced Electronics Laboratory

Fields, Waves and Optics
ELEC 4133-3 Advanced Electromagnetic Fields
ELEC 4134-3 Introduction to Microwave Circuit Design
ELEC 4333-3 Introduction to Computational Electromagnetics
ELEC 4373-3 Optical Engineering
ELEC 4644-3 Introduction to Biomedical Imaging
ELEC 4678-3 Quantum Electronics
ELEC 4688-3 Introduction to Nondestructive Testing
ELEC 4423-1 Microwave Laboratory

Computer Engineering and Embedded System Design
ELEC 4501-3 Microprocessor-based Design
ELEC 4521-1 Microprocessor-based Laboratory
ELEC 4511-3 Hardware-Software Interface Design
ELEC 4561-1 Hardware-Software Laboratory
ELEC 4723-3 High Performance Computer Architecture

Energy and Power Systems
ELEC 4164-3 Electric Drive Systems
ELEC 4174-3 Power Electronics Systems
ELEC 4184-3 Power Systems Analysis
ELEC 4170-1 Electric Drive Systems Laboratory
ELEC 4444-1 Power Systems Laboratory
ELEC 4474-1 Power Electronics Laboratory
IX. **PROFESSIONAL ELECTIVES (6 SEMESTER HOURS):**

Students are required to take two professional elective courses (6 semester credit hours), which are courses that would be beneficial to an engineering career. At least one course must be taken from the eligible ELEC courses. One course can also be selected from the non-ELEC course list.

**eligible ELEC courses (up to 2):**
- Any ELEC 4000 specialty elective or ELEC 5000-level course
- ELEC 3939 – Internship
- ELEC 4840 – Independent Study

**One non-ELEC course can be selected from the following list of courses:**
- MATH 4140 – Introduction to Modern Algebra
- MATH 4450 – Complex Variables
- MATH 4733 – Partial Differential Equations
- MATH 4810 – Probability
  - MECH 3042 – Heat Transfer
  - MECH 3147 – Bioengineering
- PHYS 3120 – Methods of Mathematical Physics
- PHYS 3811 – Quantum Mechanics
- PHYS 4351 – Bioelectromagnetism
- PHYS 4331 – Principles of Electricity and Magnetism
- PHYS 4510 – Optics
- PHYS 4610 – Computational Physics
- PHYS 4620 – Computational Physics II
- PHYS 4650 – Solid State Physics
- PHYS 4788 – Bioinformatics (Cross-listed with CSCI 4788, MATH 4788.)
- PHYS 4810 – Atomic and Molecular Structure

- CSCI 3287 – Database System Concepts
- CSCI 3320 – Advanced Programming
- CSCI 3412 – Algorithms
- CSCI 3415 – Principles of Programming Languages
- CSCI 3453 – Operating System Concepts
- CSCI 3508 – Introduction to Software Engineering
- CSCI 4034 – Theoretical Foundations of Computer Science
- CSCI 4650 – Numerical Analysis I (same as MATH 4650)
- CSCI 4761 – Introduction to Computer Networks

- ENTP 3000 - Principles of Entrepreneurship
- ENTP 3200 - Essentials in Entrepreneurship
- ENTP 3500 - Entrepreneurship Law and Ethics
X. UNIVERSITY OF COLORADO DENVER
COLLEGE OF ENGINEERING AND APPLIED SCIENCE

Common Core Curriculum Requirements

Students graduating from the College of Engineering and Applied Science are required to satisfy the humanities and social science and writing portions of their Engineering program (a minimum of 24 hrs.) by taking the following courses from the UC Denver common core curriculum:

Exceptions to the above are possible; however, such requests must be made by petition in advance.
3 HOURS OF SOCIAL SCIENCES:
One (1) course from:

CRJU 1000 Criminology & Criminal Justice: An Overview 3
ECON 2012 Principles of Economics: Macroeconomics 3
ECON 2022 Principles of Economics: Microeconomics 3
EDFN 1000 Equality, Rights, and Education 3
ENVS 1342 Environment, Society & Sustainability 3
ETST 2000 Introduction to Ethnic Studies 3
GEOG 1102 World Regions Global Contexts 3
GEOG 1602 Urban Studies and Planning 3
GEOG 2202 Hazards to Disasters: Perception & Management 3
HDFR 2200 Love, Family, and Human Development 3
INTE 2500 Digital Media and Learning 3
PBHL 1001 Race, Gender, Class, and Health 3
PBHL 2001 Intro to Public Health 4
PSCI 1001 Intro to Political Science: Quest for Freed & Justice 3
PSCI 1101 American Political System 3
PUAD 1001 Introduction to Leadership & Public Service 3
SJUS 2600 Democratic Participation & Social Justice 3
SOCY 1001 Introduction to Sociology 3
SOCY 2462 Introduction to Social Psychology 3

3 SEMESTER HOURS OF HUMANITIES
One (1) course from:

CHIN 1000 China and the Chinese 3
ENGL 1601 Telling Tales: Narrative Art in Literature & Film 3
ENGL 2600 Great Works in British & American Literature 3
ETST 2155 African American History 3
FINE 2600 Art History I: Ancient to Medieval Art 3
FINE 2610 Art History II: Renaissance to Contemporary Art 3
FREN 1000 Intro to Cultures of the French-Speaking World 3
FREN 2003 French Language III 3
FINE 2004 French Language IV: Intro to Advanced Studies 3
GRMN 1000 Germany and the Germans 3
HIST 1361 US History to 1876 3
HIST 1362 US History Since 1876 3
HIST 1381 Paths to the Present 3
HIST 1400 Controversies in History 3
LCRT 2000 Children’s & Adolescent Lit. in the 21st Century 3
PHIL 1012 Intro to Phil: Relationship of Individual to World 3
PHIL 1020 Intro to Ethical Reasoning 3
PHIL 2441 Logic, Language, and Scientific Reasoning 3
RLST 1610 Introduction to Religious Studies 3
RLST 2660 World Religions 3
SPAN 1000 Intro to Cultures of the Spanish-Speaking World 3

3 HOURS OF BEHAVIORAL SCIENCES:
One (1) course from:

ANTH 1302 Intro to Archaeology 4
ANTH 2102 Culture and the Human Experience 3
COMM 1011 Fundamentals of Communication 3
COMM 1021 Introduction to Media Studies 3
HDFR 2080 Sex, Human Development, and Family Systems 3
LING 2000 Foundations of Linguistics 3
PSYC 1000 Introduction to Psychology I 3
PSYC 1005 Introduction to Psychology II 3

3 HOURS OF ARTS:
One (1) course from:

FINE 1450 Visual Culture
FINE 1001-3. Introduction to Art
PMUS 1001-3. Music Appreciation
THTR 1001-3. Introduction to Theatre
FITV 1115 – 3 Horror in Western Culture and Cinema **New fall 2015**

3 HOURS OF CULTURAL DIVERSTITY:
ENGR 3400-3. Technology and Culture- Required

3 HOURS OF INTERNATIONAL PERSPECTIVES:
One (1) course from:

ANTH 3000 Globalization, Migration, and Transnationalism 3
CLDE 1000 Language, Power, and Identity: Int’l Perspectives 3
ENGL 3798 International Perspectives in Literature & Film 3
ENGR 3600 International Dimensions of Tech & Culture 3
ETST 3110 Indigenous Studies 3
ETST 3272 Global Media 3
FITV 1120 Contemporary World Cinema 3
FREN 3200 The Francophone World in the Post-Colonial Era 3
GRMN 3200 Current German Society and Culture 3
HDFR 1000 Global Human Development and Learning 3
HDFR 3250 Families in Global Perspectives 3
HIST 3121 The World at War, 1914-1945 3
HIST 4032 Globalization in World History Since 1945 3
INTB 3000 Global Perspectives 3
INTS 2020 Foundations of International Studies 3
PBHL 2052 Global Demography and Health 3
PHIL/RLST 3410 Asian Philosophies and Religions 3
PSCI 3022 Introduction to Comparative Politics 3
PSCI 3042 Introduction to International Relations 3
RLST 3120 Islamic Traditions 3
SOCY 3720 Global Perspectives on Social Issues 3
THTR 3550 World Theatre 3

Program Guide Fall 2017  11-01-17 updated. Core requirements
XI. STUDENT GUIDELINES

1) **REGULAR VISITS WITH FACULTY ADVISOR**- Students must meet with their faculty advisor prior to every semester to check pre-requisite requirements for courses that they plan to take. In addition, the advisor checks to see that everything is “on track” with regard to satisfactory progress towards the BSEE degree. Most persons do seek employment during and/or after their schooling, and references are customarily a part of job applications. Thus, it is in a student’s best interest that he/she gets to know his/her faculty advisor(s) and other faculty members well enough that they can serve as references in the future.

2) **CURRICULUM CHANGES** - Students should obtain a copy of the latest ELEC Advisement Guide from the Electrical Engineering office for any updates and/or changes. Students are expected to follow the curriculum which was published at the date they first enrolled at UC Denver.

3) **ADVISING FOR TRANSFER OF CREDITS INTO ELEC PROGRAM** – There are two levels of transfer advising available.
   A) INFORMAL transfer advising is done on an ad-hoc basis using unofficial transcripts, catalogs, and so forth.
   B) FORMAL documented transfer advising is done only AFTER the UCD Admissions Office has issued an “Applicant Transfer Credit Evaluation,” and the student has been admitted to the College of Engineering and Applied Science. The formal transfer of credit into the ELEC program must be requested, or initiated, by the student. It is recommended that this should be done as soon as the student has been accepted into the ELEC program. It is the responsibility of the student to see that transfer credits are entered into the UC Denver system. This is done by requesting that transcripts from other institutions are forwarded to the UC Denver office of admissions and records. Transfer credits can then be evaluated by the appropriate department (i.e. Math credits are evaluated by the math department and so on). Appointments for either form of transfer advising are made through the departmental office.

4) **30-HOUR SENIOR CHECKOUT** - After completing approximately 90 semester hours toward the BSEE degree (junior year of program), each student must request that a 30-hour senior checkout be done by the department. (Should the student have some applicable transfer credits, he/she should first request a FORMAL transfer evaluation (See Item 3).) During the 30-hour senior checkout, the courses needed to complete the student’s study program are specified on the 30-hour checkout form. A 30-hour checkout is only valid for two years. If a student does not graduate during this time period, another checkout must be requested. Appointments for 30-hour checkouts are made through the departmental office.
5) **GRADUATION AGREEMENT** - Prior to the last semester each student must request that a graduation agreement be completed. This agreement specifically states the exact courses that must be satisfactorily completed during the final semester of the student’s program. Appointments for graduation agreements are made through the departmental office.

6) **PRE-APPROVAL OF ANY CURRICULAR DEVIATIONS (OR PETITIONS)** - Any deviation from the approved curriculum must be approved BEFORE taking the course or lab. Approval is obtained via a departmental petition. It is recommended that all petitions be submitted for departmental approval at least four (4) weeks in advance before the “LAST DAY TO REGISTER, DROP OR ADD” that is published in the Schedule of Classes for that semester. Curricular deviations requested after this date will be denied.

7) **REQUIRED GRADES IN PREREQUISITES** - Students are required to successfully complete the courses with a C-(or higher) grade in any pre-requisite course before taking the subsequent course. Students may NOT register for credit in a course in which they already have received a grade of C- or higher. (They may enroll for a “NC” grade only.)

8) **PRE-ENGINEERING STUDENTS IN OTHER COLLEGES** - All potential Electrical Engineering students attending UC Denver should obtain a copy of the latest Electrical Engineering Printed Advisement Guide from the Electrical Engineering Office on a regular basis and should follow its curriculum. (See Item 2.) Students needing additional information may make an appointment to see an advisor through the departmental office.

9) **COURSES RESTRICTED TO EE STUDENTS** – All upper-division ELEC courses are restricted. Thus, it is imperative that students enroll in the College of Engineering and Applied Science as early as possible.

10) **GRADE POINT AVERAGE (GPA) REQUIREMENTS** - To remain in good standing within the College of Engineering and Applied Science, each student must maintain a 2.00 (or greater) cumulative average as calculated in each of the following three ways:
    a) All courses attempted within the CU system (overall GPA).
    b) All courses that are counted as part of his/her study program.
    c) All ELEC courses attempted.

In order to earn a BSEE degree from UC Denver, each student must achieve a 2.00 (or greater) average at the time of graduation as calculated in each of the three ways described above.

11) **ADDITIONAL ELECTRICAL ENGINEERING DEPARTMENT RULES AND POLICIES** – The following additional department rules and policies will take effect beginning in the Fall 2012 term:
a) Once a student has enrolled in the UC Denver College of Engineering and Applied Science, ELEC courses may not be transferred in from outside the CU system. Pooled and core courses may still be transferred as per the statewide articulation agreement except any math courses. Math classes are required to be taken on UCD campus in person.(CEAS Math policy May 9th 2013.)

b) Residency requirement. All of the last 40 ELEC credits (at least) must be taken at UC Denver to earn a BSEE in electrical engineering from UC Denver.

c) Where pre-requisite requirements allow, it is possible that students may simultaneously take ELEC courses from two subsequent years in the program (i.e. ELEC 2142 may be taken co-req. with ELEC 3215). Students may not take ELEC classes that span more than two subsequent years (i.e. all ELEC (1) thousand classes must be completed before taking any ELEC (3) thousand classes, all ELEC (2) thousand classes must be completed before taking any ELEC (4) thousand classes and all ELEC (3) thousand classes must be completed before taking any ELEC (5) thousand classes).

d) Pre-requisite violations. Mandatory pre-semester advising is given to all students every semester to ensure that pre-requisite course requirements are understood and adhered to. Students who intentionally attempt to sign up for classes that they do not have the necessary pre-requisites will be administratively dropped and will not receive any tuition refund. Repeat offenders will automatically be assigned a grade of “F” for the course.

e) Independent Study. The independent study course (ELEC 4840) may be used in cases where a student wishes to pursue study in a subject beyond regularly offered courses and there is a full time faculty member willing to mentor that student. Only full time faculty members may supervise an independent study, which must be approved by the faculty sponsor prior to the beginning of the semester. Independent study may not be used as a substitute for a required course, only as a professional elective.

f) Graduate level courses are counted for both BSEE and MSEE requirements. To encourage students to pursue a graduate degree after graduation from UC Denver, up to two ELEC graduate level courses (6 credits) completed with a B- or better may be counted toward the BSEE degree and subsequently applied to the MSEE degree. See the Electrical Engineering graduate brochure for graduate school admission requirements.

12) ADDITIONAL COLLEGE RULES AND REGULATIONS - Each student should be aware that there are rules, regulations, and requirements within the College of Engineering and Applied Science, which are published annually in the UCD catalog.

13) TRANSFER CREDIT GUIDELINES – All transfer credit will be evaluated by the department transfer credit advisor. Since every transfer case is unique, the following guidelines are intended to illustrate how the transfer credit process works and not to provide specific rules that apply to all cases. Please note that if transfer credit from outside the state of Colorado is to be used to satisfy ELEC pre-requisites, such
transfer credit must be evaluated no later than the week before classes start. In most situations, transfer credits fit into one of the following categories:

a) Transfer of credits from any public Colorado community college. By statewide inter-institutional agreement, all required math, science and lower division humanities may be transferred from any community college. Typically, community college calculus courses are 5 credits, which will satisfy the university requirement of 4 credits per calculus class. The extra credit from the community college is not applicable toward the BSEE degree.

b) Transfer of engineering credits from an ABET accredited university. In order for technical classes to transfer in to the BSEE program at UC Denver, both the credit hour count for the class and the content of the course (catalog description) must match the UC Denver requirement. Since program structures vary between institutions, it is possible that some courses may not be transferable or that only a fraction of credit earned is applicable. (Note that 4 quarter hours translates to 2.7 semester hours.) Both the course content and the credit hour count must be in agreement with the UC Denver BSEE requirements. In all cases, at least the last 40 ELEC credit hours must be completed within the UC Denver EE department to earn a BSEE degree from UC Denver.

c) Transfer of credits from non-ABET accredited or foreign universities. This is the most difficult transfer situation since ABET requires that the department take responsibility for verification of course content. It is often the case that course content from other programs only partially coincides with the UC Denver requirements or that complete documentation is not available. In these cases, students are asked to take at least two UC Denver courses that are equivalent to the highest level courses that were taken elsewhere. This helps to validate the students’ knowledge of the subject and preparation for UC Denver ELEC courses. In general, students must take at least two ELEC 3xxx courses before enrolling in ELEC 4xxx classes. It may also be appropriate to ask the student to take an informal test to help in the evaluation of knowledge. In all cases, at least the last 40 ELEC credit hours must be completed within the UC Denver EE department to earn a BSEE degree from UC Denver.