College of Engineering,
Design and Computing
UNIVERSITY OF COLORADO **DENVER**

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Bachelor of Science in Electrical Engineering (BSEE)
Advisement Guide

Curriculum

	Semester 1	CRS
Year One	MATH 1401 Calculus I	4
	ENGR 1130 Chemistry for Engineers	5
	ENGR 1200 Intro. to Engineering Design	3
	ELEC 1510 Digital Logic	3
		15

	Semester 2	CRS
	PHYS 2311/2321 General Physics I & Lab	5
	MATH2411 Calculus II	4
	ELEC 1520 Programming for EE	3
	ELEC 2531 Logic Laboratory	1
	ENGL 1020 Core Composition I	3
		16

	Semester 3	CRS
Year Two	MATH2421 Calculus III	4
	ELEC 2132 Circuits Analysis I	3
	PHYS 2331 General Physics II	4
	ENGL 2030 Core Composition II	3
	Math 3195 Linear Algebra & Differential Equations	4
		18

	Semester 4	CRS
	ELEC 2142 Circuits Analysis II	3
	ELEC 2520 Embedded Systems Engr.	3
	ELEC 2651 Signal Processing	3
	ELEC 3133 Electromagnetic Fields	3
	CU Core Curriculum Course	3
		15

	Semester 5	CRS
Year Three	ELEC 3817 Engineering Probability and Stats. (FALL ONLY)	3
	ELEC 3225 Electronics	4
	ELEC 3316 Signals and Systems	3
	CU Core Curriculum Course	3
	CU Core Curriculum Course	3
		16

	Semester 6	CRS
	ELEC 3164 Energy Systems	3
	ELEC 3520 AI-IOT (SPRING ONLY)	3
	ELEC 3701 Machine Learning (SPRING ONLY)	3
	ELEC 3724 Energy Systems Lab	1
	ELEC 4xxx Specialty Course	3
	CU Core Curriculum Course	3
		16

	Semester 7	CRS
Year Four	ELEC 4309 Senior Design I project- (FALL ONLY)	3
	ENGR 3400 Technology and Culture	3
	ELEC Specialty 4xxx	3
	ELEC Specialty 4xxx & Lab	4
	ELEC 3900 Circuit Design and Fabrication (FALL & SUMMER)	3
		16

	Semester 8	CRS
	ELEC 4319 Senior Design II project-- (SPRING ONLY)	3
	ELEC Specialty 4xxxx & Lab	4
	ELEC Specialty 4xxx	3
	Professional Elective	3
	CU Core Curriculum Course	3
		16

Each student MUST follow the rules of the Department of Electrical Engineering (EE) as outlined

I   **Intellectual Competencies (6 semester hours)** (see Section IX, p. 5)
Competency is satisfied by a letter grade of C- or higher. Pass/fail is not allowed. Complete all of the following:
ENGL 1020-3   Core Composition I
ENGL 2030-3   Core Composition II

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II   Common Core Courses (18 semester hours) (see Section IX, p. 5)

SOCIAL SCIENCES: one course

BEHAVIORAL SCIENCES: one course

HUMANITIES: one course

ARTS: one course

CULTURAL DIVERSITY: for the EE dept. We require ELEC 3400 to meet this requirement.

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 can substitute for 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 or	Engineering General Chemistry
CHEM 1130-5	Engineering General Chemistry (if taken prior to Spring of 2017)

V   EE Required Courses (39 semester hours)

ENGR 1200-3	Introduction to Engineering Design†	ELEC 3133-3	Electromagnetic Fields
ELEC 1510-3	Digital Logic	ELEC 3164-3	Energy Systems
ELEC 1520-3	Program for Engineers I	ELEC 3225-4	Electronics
ELEC 2132-3	Circuit Analysis I	ELEC 3316-3	Signals and Systems
ELEC 2142-3	Circuit Analysis II	ELEC 3520-3	AI- IoT
ELEC 2520-3	Embedded Systems	ELEC 3701-3	Machine Learning
ELEC 2531-1	Logic Laboratory	ELEC 3724-1	Energy Systems Lab
ELEC 2651-3	Signal Processing	ELEC 3817-3	Probability and Statics
		ELEC 3900-3	Circuit Design and Fabrication Laboratory

VI   EE Required Senior Design Sequence (6 Semester Hours)

ELEC 4309-3	Senior Design Project I
ELEC 4319-3	Senior Design Project II

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VII   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, Controls, and Signal Process
ELEC 4637-3 Digital Signal Processing
ELEC 4248-3 Digital Communication Systems
ELEC 4212-3 Reliability Engineering
ELEC 4136-3 Control Systems Analysis
ELEC 4276-3 Digital Control Systems
ELEC 4375-3 Engineering Neuroscience
ELEC 4637-3 Digital Signal Processing
ELEC 4406-1 Control Systems Laboratory

Microelectronics and VLSI
ELEC 4005-3 IC Design
ELEC 4025-3 Device Electronics
ELEC 4225-3 Advanced Electronics
ELEC 4555-3 VLSI Circuit Simulation
ELEC 4455-3 CMOS Design
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 Intro Biomedical Imagining
ELEC 4423-1 Radio Frequency Laboratory

Computer Engineering and Embedded System Design
ELEC 4511-3 Hardware-Software Interface Design
ELEC 4678-3 Intro to Quantum Computing.
ELEC 4679-3 Quantum Computing Algorithms
ELEC 4680-3 Quantum Computing Technology
ELEC 4727-3 Machine Vision Systems
ELEC 4561-1 Hardware-Software Laboratory

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Energy and Power Systems
ELEC 4154-3 Electric and Hybrid Vehicle Powertrains
ELEC 4164-3 Electric Machines and Drives Systems
ELEC 4174-3 Power Electronics Systems
ELEC 4184-3 Power Systems Analysis
ELEC 4755-3 Grid Integration of Renewable Energy
ELEC 4170-1 Electric Machines and Drives Laboratory
ELEC 4444-1 Power Systems Laboratory
ELEC 4474-1 Power Electronics Laboratory

VIII   <u>**Professional Electives (3 semester hours):**</u>
Students are required to take one professional elective courses (3 semester hours), which are courses that would be beneficial to an engineering career.   One course can also be selected from the non-ELEC course list or from an additional ELEC 4xxx. Students must have the pre-requisites for the course prior to registering.

eligible ELEC courses :
Any ELEC 4000 specialty, elective or ELEC 5000-level course
ELEC 3939-3 Internship
ELEC 4840-3 Independent Study

Non-ELEC course can be selected from the following list of courses:
MATH 3800-3   Statics for Engineers
MATH 4140-3 Introduction to Modern Algebra
MATH 4450-3 Complex Variables
MATH 4733-3 Partial Differential Equations
MATH 4810-3 Probability

MECH 3042-3 Heat Transfer
MECH 3147-3 Bioengineering

PHYS 3120-3 Methods of Mathematical Physics
PHYS 3811-3 Quantum Mechanics
PHYS 4351-3 Bioelectromagnetism
PHYS 4331-3 Principles of Electricity and Magnetism
PHYS 4510-3 Optics
PHYS 4610-3 Computational Physics
PHYS 4620-3 Computational Physics II
PHYS 4650-3 Solid State Physics
PHYS 4788-3 Bioinformatics (Cross-listed with CSCI 4788, MATH 4788.)
PHYS 4810-3 Atomic and Molecular Structure

CSCI 3287-3 Database System Concepts
CSCI 3320-3 Advanced Programming
CSCI 3412-3 Algorithms
CSCI 3415-3 Principles of Programming Languages
CSCI 3453-3 Operating System Concepts

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CSCI 3508-3 Introduction to Software Engineering
CSCI 4034-3 Theoretical Foundations of Computer Science
CSCI 4650-3 Numerical Analysis I (same as MATH 4650)
CSCI 4761-3 Introduction to Computer Networks

IWKS4800-3 StartUp: Creating a New Venture from Scratch

ENTP 3000-3 Principles of Entrepreneurship
ENTP 3200-3 Essentials in Entrepreneurship
ENTP 3500-3 Entrepreneurship Law and Ethics

IX University of Colorado Denver (CU Denver), College of Engineering, Design and Computing (CEDC)

Students graduating from the CEDC 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 CU Denver common core curriculum:

CU Denver Core Requirements (Link)

Philosophy of the Core:

The core curriculum of the CU Denver Downtown Campus is designed to provide each undergraduate student with a high quality general education based on a liberal arts foundation, while allowing students flexibility based on their individual backgrounds and specific career goals. The Core Curriculum develops multiple literacies, stimulates creative thinking, and utilizes technology. A goal of the CU Denver Core Curriculum is to engage students in developing sensitivity to diversity and developing their place in an urban environment as well as in the rapidly changing global environment.

X 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 EE Advisement Guide from the EE Office for any updates and/or changes. Students are expected to follow the curriculum which was published at the date they first enrolled at CU Denver.

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3) **ADVISING FOR TRANSFER OF CREDITS INTO EE 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 CU Denver Admissions Office has issued an "Applicant Transfer Credit Evaluation," and the student has been admitted to the CEDC. The formal transfer of credit into the EE 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 EE program. It is the responsibility of the student to see that transfer credits are entered into the CU Denver system. This is done by requesting that transcripts from other institutions are forwarded to the CU 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.

8) **PRE-ENGINEERING STUDENTS IN OTHER COLLEGES**: All potential EE students attending CU Denver should obtain a copy of the latest EE Printed Advisement Guide from the EE 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.

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9) **COURSES RESTRICTED TO EE STUDENTS**: All upper-division ELEC courses are restricted. Thus, it is imperative that students enroll in the CEDC as early as possible.

10) **GRADE POINT AVERAGE (GPA) REQUIREMENTS:** To remain in good standing within the CEDC, 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 CU 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 EE DEPARTMENT RULES AND POLICIES:**

    a) Once a student has enrolled in CU Denver's ELEC courses may not be transferred in from outside the CU system unless they are petition and approved by the Chair. Pooled and core courses may still be transferred as per the statewide articulation agreement except any math courses.
    b) Residency requirement. All of the last 40 ELEC credits (at least) must be taken at CU Denver to earn a BSEE degree from CU Denver.
    c) 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.
    d) 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.
    e) Graduate level courses are counted for both BSEE and MSEE requirements. To encourage students to pursue a graduate degree after graduation from CU 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 EE graduate brochure for graduate school admission requirements.
    f) EE Scholar Program: The **EE Scholars Program** provides students the opportunity to begin graduate work at the master's level while completing the undergraduate degree in EE. In the process, it allows students to receive dual credit for up to 12 hours of graduate-level EE courses for both the BSEE and the Master of Science (MS) degree, if their undergraduate

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GPA was at least 3.0. This accelerates the time to degree for the student, saving both time and expense.

12) **ADDITIONAL COLLEGE RULES AND REGULATIONS**: Each student should be aware that there are rules, regulations, and requirements within CEDC, which are published annually in CU Denver's 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 CU Denver, both the credit hour count for the class and the content of the course (catalog description) must match the CU 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 CU Denver BSEE requirements. In all cases, at least the last 40 ELEC credit hours must be completed within the CU Denver EE Department to earn a BSEE degree from CU 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 CU Denver requirements or that complete documentation is not available. In these cases, students are asked to take at least two CU 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 CU 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 CU Denver EE department to earn a BSEE degree from CU Denver.

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