EXECUTIVE COMMITTEE
BOURNS COLLEGE OF ENGINEERING
REPORT TO THE RIVERSIDE DIVISION
MAY 25, 2021

To be adopted:

Proposed Changes to Electrical Engineering
College Requirements and Major Requirements

PRESENT:

College Requirements
See The Marlan and Rosemary Bourns College of Engineering, Colleges and Programs section.

The Electrical Engineering major uses the following major requirements to satisfy the college’s Natural Sciences and Mathematics breadth requirement.

1. One course in the biological sciences chosen from an approved list
2. CHEM 001A, CHEM 01LA
3. MATH 008B or MATH 009A
4. PHYS 040A, PHYS 040B

PROPOSED:

[no change]

Major Requirements

1. Lower-division requirements (74 units)
   a) One course in the biological sciences chosen from an approved list
   b) CHEM 001A, CHEM 01LA
   c) CS 010, CS 013, CS 061
   d) EE 001A, EE 01LA, EE 001B, EE 010, EE 020
   e) MATH 008B or MATH 009A, MATH 009B, MATH 009C, MATH 010A, MATH 010B, MATH 046
   f) PHYS 040A, PHYS 040B, PHYS 040C

2. Upper-division requirements (81 units)
   a) EE 100A, EE 100B, EE 105, EE 110A, EE 110B, EE 114, EE 116, CS 120A/EE 120A, CS 120B/EE 120B, EE 123, EE 133, EE 141, EE 175A, EE 175B
   b) One of EE 128 or EE 155
   c) ENGR 181W
   d) Sixteen (16) units of technical electives chosen from CS 161, CS 168/EE 168, EE 115, EE 117, EE 118, EE 123, EE 128 (if not chosen as a required course

PROPOSED:

[no change]

Major Requirements

1. Lower-division requirements (73 units)
   a) One course in the biological sciences chosen from an approved list
   b) CS 010A, CS 010B, CS 061
   c) EE 016
   d) EE 010, EE 020A, EE 020B, EE 030A, EE 30LA, EE 030B
   e) MATH 008B or MATH 009A, MATH 009B, MATH 009C, MATH 010A, MATH 010B
   f) PHYS 040A, PHYS 040B, PHYS 040C

2. Upper-division requirements (77 units)
   a) EE 100A, EE 110A, EE 110B, EE 114, EE 116, CS 120A/EE 120A, CS 120B/EE 120B, EE 132, EE 133, EE 142, EE 175A, EE 175B
   b) ENGR 181W
   c) Twenty-four (24) units of technical electives chosen from CS 161, CS 162, CS 168/EE 168; EE 105, EE 106, EE 100B, EE 115, EE 117, EE 118, EE 123, EE 128, EE 135, EE 136, EE 137, EE 138, EE 139, EE 141, EE 144, EE 145/ME 145, EE 146, EE 147, EE 148, EE 150, EE 151, EE
in b) above), EE 135, EE 136, EE 137, EE 138, EE 139, EE 142, EE 144, EE 145/ME 145, EE 146, EE 147, EE 150, EE 151, EE 152, EE 153, EE 155 (if not chosen as a required course in b) above), EE 162, EE 165, ENGR 160

To ensure depth, the choice of technical electives must include at least one coherent sequence of at least three (3) electrical engineering courses (lead course plus two additional) in one focus area of electrical engineering, as defined below.

Communications, Signal Processing and Networking. Lead Course: EE 141. Sequence Courses: EE 115, EE 117, EE 118, EE 128, EE 146, EE 150, EE 152, ENGR 160

Control and Robotics. Lead Course: EE 132. Sequence Courses: EE 128, EE 142, EE 144, EE 145/ME 145, EE 146, EE 151, EE 152, ENGR 160

Embedded Systems and VLSI. Lead Course: EE 128. Sequence Courses: EE 135, EE 147, EE 165, CS 168/EE 168, CS 161, ENGR 160

Intelligent Systems. Lead Course: EE 142. Sequence Courses: EE 144, EE 145, EE 146, EE 152, ENGR 160

Nanotechnology, Advanced Materials, and Devices. Lead Course: EE 133. Sequence Courses: EE 117, EE 136, EE 137, EE 138, EE 139, EE 162

Power Systems and Smart Grid. Lead Course: EE 155. Sequence Courses: EE 117, EE 123, EE 128, EE 153, ENGR 160

Example course sequences are available through the Student Affairs Office in the College of Engineering or student.engr.ucr.edu

To ensure depth, the choice of technical electives must include at least one coherent sequence of at least four (4) courses (two required courses plus two additional) in one focus area of electrical engineering, and two (2) other technical elective courses, as defined below.

Communications, Signal Processing and Networking. Required courses: EE 115, EE 141, Sequence Courses: EE 100B, EE 117, EE 118, EE 146, EE 150, EE 152, ENGR 160

Control and Robotics. Required Courses: EE 105, EE 144. Sequence Courses: EE 106, EE 141, EE 145/ME 145, EE 146, EE 151, EE 152, ENGR 160

Embedded Systems and VLSI. Required Courses: EE 128, EE 168. Sequence Courses: EE 100B, EE 117, EE 118, EE 135, EE 141, EE 147, EE 165, CS 161, CS 162

Intelligent Systems. Required Courses: EE 144, EE 146. Sequence Courses: EE 105, EE 106, EE 115, EE 128, EE 141, EE 145, EE 147, EE 150, EE 151, EE 152, ENGR 160

Nanotechnology, Advanced Materials, and Devices. Required Courses: EE 136, EE 137. Sequence Courses: EE 100B, EE 117, EE 118, EE 135, EE 138, EE 139, EE 162, EE 168

Power Systems and Smart Grid. Required Courses: EE 123, EE 155. Sequence Courses: EE 100B, EE 117, EE 128, EE 153, ENGR 160

[no change]
**Justification:**

1. Removal of CHEM 001A, CHEM 01LA from the breadth requirements and their replacement with PHYS 040C

The number of courses that ECE students take from the College of Natural Sciences and Mathematics substantially exceeds the number of courses required otherwise to satisfy the BCOE’s breadth requirement. It was decided that specialized courses from the ECE department would be more beneficial to the background of students than the breadth courses in Chemistry. Since it is required to have 20 units of college breadth requirements, we formally added PHYS 040C instead. Note that PHYS 040C was always our curriculum requirement.

2. Replacement of CS 010 with CS 010A

This is just an update to reflect the course number changes introduced by CS&E Department.

3. Replacement of CS 013 with CS 010B

It was decided that CS 010B course is more suitable for electrical engineering curriculum.

4. Replacement of EE 001A, EE 01LA, EE 001B by EE 030A, EE 30LA, EE 030B

Courses EE 001A, EE 01LA, EE 001B underwent substantial content modifications. This reflects a long-overdue reorganization of the course content to better serve the students and address many concerns that we have seen over the years. The course numbers were also changed since we already have EE 003, EE 004, EE 005, EE 010, EE 020A, EE 020B numbers for courses that are of much more introductory level. In fact, EE 020A is now a prerequisite for EE 030A. EE 020B is just a renumbering of existing course EE 020.

5. Sixteen (16) units of required technical electives was increased to twenty-four (24) units of required technical electives.

Our undergraduate curriculum over-went a major revision. This increase in the number of required technical elective course was the result of this revision. It will allow students to get depth in their areas of interest.

6. Addition of CS 162, EE 105, EE 106, and EE 100B to list of twenty-four (24) units of required technical electives.

These courses are relevant to the EE focus areas and are being added.

7. Lead courses in focus areas were removed since some lead courses were required by core curriculum courses anyway. This was causing confusion for many students. Lead courses in focus areas are now replaced by the required specialized courses that are not part of core course requirements.

8. The pool of technical elective courses in all focus areas was substantially increased to accommodate different student interests.

9. Replacement of EE 141 with EE 142 as a required course.
EE 141 is a required course for Communications, Signal Processing and Networking focus area, and is an elective in many other areas. Faculty felt that the basics needed for all EE students are covered in EE 110A and EE 110B and everyone did not need the digital signal processing material covered in EE 141. Most EE programs at other universities require courses equivalent to EE 110A and EE 110B, and not EE 141. On the other hand, it was felt that basic machine learning and pattern recognition covered by EE 142 is needed across all areas. Our Board of Advisors strongly recommended that EE students need to know some aspects of machine learning to be competitive in the job market. Many other EE programs that we considered are also adding aspects of machine learning and data analysis in their core curriculum.

10. Removal of EE 105 from the set of required courses.

It was felt that topics of EE 105 are required for the Control and Robotics focus area only, but not for other focus areas. Such a course is not part of almost any EE program at other universities that the department reviewed.

11. Replacement of MATH 046 with EE 020A.

EE 020A is introduced to provide mathematical principles and tools fundamental to the core background of ECE students. The course introduces complex numbers, ordinary differential equations and methods of their solution with particular emphasis on utilizing Laplace Transform and Fourier Series/Transform. The course will develop a critical skill-set necessary for successful understanding of the material in upper division ECE courses such as Signals and Systems, Robotics and Control Systems, Automatic Control, etc. Application examples in those areas will be provided throughout the course. The course will also introduce elements of mathematical modeling of signals and systems using Matlab/Simulink software. The content of the course draws heavily on feedback by EE and CE faculty, ABET reviewers, and Board of ECE advisers that includes many ECE alumni.

12. Removal of EE 105 from list of sequence courses in the Control and Robotics focus area.

EE 105 is a required course in this focus area as was previously (and is now) indicated and approved.

13. Lower Division Requirement Units

There was a miscalculation of the total number of units in the old catalog. Correct number of units must be 73.

14. Removal of MATH 008B

MATH 008B has been removed as it is no longer offered on campus.

**Approvals:**
Approved by the Department of Electrical & Computer Engineering: June 10, 2020
Approved by the Executive Committee of the College of Engineering: January 13, 2021
Approved by the Committee on Educational Policy: April 22, 2021