EXECUTIVE COMMITTEE
BOURNS COLLEGE OF ENGINEERING
REPORT TO THE RIVERSIDE DIVISION
MAY 26, 2020

To be adopted:

Proposed Changes to Electrical Engineering

PRESENT:	**PROPOSED:**
Undergraduate Program **Focus Areas** The electrical engineering undergraduate program offers the following focus areas:	[no change]
1. **Communications, Signal Processing and Networking:** Fundamental and state-of-the-art theory and applications of acquisition, processing, and transmission of digital signals and images over wire, wireless (radio frequency), fiber optics, etc. Example applications include speech processing and recognition, mobile communication using smartphones, fiber optical communication, image enhancement and compression.	[no change]
2. **Control~~, Robotics and Machine Intelligence:~~** ~~Theory and design of control of systems and robots, and systems capable of intelligent decisions. Example applications include control systems in automotive, satellite, aircraft, computer hard drive, robotic manufacturing, autonomous robots, cell phone signal tracking, computer vision and intelligent transportation systems.~~	2. **Control and Robotics:** Fundamental theory, design and applications of feedback control systems and autonomous robots capable of making intelligent decisions. Example applications include automotive, marine, aircraft, and satellite control systems; motion planning, control and decision making for autonomous unmanned aerial, ground, surface, and underwater vehicles; autonomous positioning and navigation; advanced robotic manufacturing; and machine vision.
3. **Embedded Systems and VLSI:** Theory, design and methodologies of embedded system using microcontrollers, very large scale, nanometer integrated circuits. Example applications include smart home appliances, Internet of Things, microprocessors, analog and mixed signal circuits, RF circuits for cell phones and wireless networks, system-on-chip and wireless networks, system-on-chip.	[no change]
4. **~~Nanotechnology, Advanced Materials and Devices:~~** ~~Synthesis and characterization of advanced materials at nanometer scale, theory, design and fabrication of electronic and optoelectronic devices. Example applications~~	4. **Intelligent Systems:** Foundations and applications for acquisition and analysis of multi-modal data, and inference for intelligent pattern recognition, machine learning, and decision making. Examples include, learning from sensor

~~include creation of ultra-fast low-power transistors, efficient solar cells for energy generation, high-density memory for smart phones and mobile services, and tiny devices for medical applications.~~	data; pattern recognition, computer vision, and image processing; system approximation and modeling; decision-making under uncertainty; probabilistic robotics; and intelligent transportation systems.
5. **~~Power Engineering:~~** ~~Power electronics, AC and DC power and their conversion, electro-mechanical energy conversion, electric motors, large-scale power genertion and transmission systems, long-distance transmission and distribution of electric power, design of motion control drive circuits for robotic and industrial automation systems, and other related topics.~~	5. **Nanotechnology, Advanced Materials, and Devices:** Synthesis and characterization of advanced materials at nanometer scale, theory, design and fabrication of electronic and optoelectronic devices. Example applications include creation of ultra-fast low-power transistors, efficient solar cells for energy generation, high-density memory for smart phones and mobile services, and tiny devices for medical applications. 6. **Power Systems and Smart Grid:** Power electronics, AC and DC power and their conversion, electro-mechanical energy conversion, electric motors, large-scale power generation and transmission systems, long-distance transmission and distribution of electric power, design of motion control drive circuits for robotic and industrial automation systems, and other related topics.
All undergraduates in the College of Engineering must see an advisor at least annually. For details, visit **student.engr.ucr.edu**.	[no change]
University Requirements See Undergraduate Studies section.	[no change]
College Requirements See The Marlan and Rosemary Bourns College of Engineering, Colleges and Programs section.	[no change]
The Electrical Engineering major uses the following major requirements to satisfy the college's Natural Sciences and Mathematics breadth requirement.	[no change]
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	[no change]

Major Requirements	**Major Requirements**
1. **Lower-division requirements (7~~3~~ units)**	1. **Lower-division requirements (74 units)**
a) One course in the biological sciences chosen from an approved list	a) One course in the biological sciences chosen from an approved list
b) CHEM 001A, CHEM 01LA	b) CHEM 001A, CHEM 01LA
c) CS 010, CS 013, CS 061	c) CS 010, CS 013, CS 061
d) EE 001A, EE 01LA, EE 001B, EE 010, EE 020	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	e) MATH 008B or MATH 009A, MATH 009B, MATH 009C, MATH 010A, MATH 010B, MATH 046
f) PHYS 040A, PHYS 040B, PHYS 040C	f) PHYS 040A, PHYS 040B, PHYS 040C
2. **Upper-division requirements (81 units)**	[no change]
a) EE 100A, EE 100B, EE 105, EE 110A, EE110B, EE 114, EE 116, CS 120A/EE 120A, CS 120B/EE 120B, EE 132, 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 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.	[no change]
• 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	[no change]
• Control~~, Robotics and Machine Intelligence~~. Lead Course: EE 132. Sequence Courses: EE 128, EE 142, EE 144, EE 145/ME 145, EE 146, EE 151, 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	[no change]
~~• Nanotechnology, Advanced Materials and Devices. Lead Course: EE 133. Sequence Courses:~~	• Intelligent Systems. Lead Course: EE 142. Sequence Courses: EE 144, EE 145, EE 146, EE

~~EE 117, EE 136, EE 137, EE 138, EE 139, EE 162~~	152, ENGR 160
~~• Power Engineering. Lead Course: EE 155. Sequence Courses: EE 117, EE 123, EE 128, EE 153, 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**	[no change]

Justification:

1. Adding a comma to focus areas 1 and 5's names to make grammatically correct

2. Change to Focus Area 2 (name and description) and addition of new focus area, "Intelligent Systems"

Control, Robotics and Machine Intelligence is overly broad and does not convey the idea that it includes machine learning and intelligent systems, although relevant courses are included. "Intelligent Systems" carves out a set of courses that are relevant to pattern recognition, machine learning, and intelligent systems.

3. Change to Focus Area 6's name to "Power Systems and Smart Grid"

"Power Systems and Smart Grid" reflects contemporary issues better, such as management of electricity supply networks, digital control of power system networks, etc., in contrast to just generation, transmission, and distribution of power that classical Power Engineering is dealing with.

4. Typo in Focus Area 6's description.

Correct spelling is "generation"

5. EE 010's overall units updated from 1 to 2 units. The course has a 2 hour/week lecture plus 1-hour hands-on experience (e.g. students actually learn some processes in the IEEE workshop). Hence, it is more appropriate to have 2 units. This increases the overall lower-division major requirements to 74 units.

6. Reordering of focus areas (that includes new area) to make in alphabetical order.

Approvals:

Approved by the Department of Electrical & Computer Engineering:	September 23, 2019
Approved by the Executive Committee of the College of Engineering:	December 9, 2019
Approved by the Committee on Educational Policy:	April 8, 2020