Computer Engineering Major

UCLA General Catalog 2017-18 ~~strikethrough~~ to be *deleted*	Proposed changes to the text in the next catalog underlined to be *added*
Computer Engineering B.S. The Computer Engineering major is a designated capstone major that is jointly administered by the Computer Science and Electrical and Computer Engineering departments. Undergraduate students complete a design course in which they integrate their knowledge of the discipline and engage in creative design within realistic and professional constraints. Students apply their knowledge and expertise gained in previous mathematics, science and engineering coursework. Students identify, formulate and solve engineering problems and present their projects to the class. **Capstone Major** The undergraduate curriculum provides all Computer Engineering students with preparation in the mathematical and scientific disciplines that lead to a set of courses that span the fundamentals of the discipline in the major areas of data science and embedded networked systems. These collectively provide an understanding of many inventions of importance to our society, such as the Internet of Things, Human-Cyber-Physical Systems, Mobile/Wearable/Implantable Systems, Robotic Systems, and more generally "Smart" Systems at all scales in diverse spheres. The design of hardware, software, and algorithmic elements of such systems represents an already dominant and rapidly growing part of the Computer Engineering profession. Students are encouraged to make use of their Computer Science and Electrical and Computer Engineering Electives and a two-quarter Capstone Design Course to pursue deeper knowledge within one of these areas according to their interests, whether for graduate study or	**Computer Engineering B.S.** The Computer Engineering major is a designated capstone major that is jointly administered by the Computer Science and Electrical and Computer Engineering departments. Undergraduate students complete a design course in which they integrate their knowledge of the discipline and engage in creative design within realistic and professional constraints. Students apply their knowledge and expertise gained in previous mathematics, science and engineering coursework. Students identify, formulate and solve engineering problems and present their projects to the class. **Capstone Major** The undergraduate curriculum provides all Computer Engineering students with preparation in the mathematical and scientific disciplines that lead to a set of courses that span the fundamentals of the discipline in the major areas of data science and embedded networked systems. These collectively provide an understanding of many inventions of importance to our society, such as the Internet of Things, Human-Cyber-Physical Systems, Mobile/Wearable/Implantable Systems, Robotic Systems, and more generally "Smart" Systems at all scales in diverse spheres. The design of hardware, software, and algorithmic elements of such systems represents an already dominant and rapidly growing part of the Computer Engineering profession. Students are encouraged to make use of their Computer Science and Electrical and Computer Engineering Electives and a two-quarter Capstone Design Course to pursue deeper knowledge within one of these areas according to their interests, whether for graduate study or

preparation for employment. **Preparation for the Major** *Required:* Computer Science 1, 31, 32, 33, 35L, M51A (or Electrical and Computer Engineering M16); Electrical and Computer Engineering 3, 10, 11L; Mathematics 31A, 31B, 32A, 32B, 33A, 33B, 61; Physics 1A, 1B, 1C, 4AL; Engineering 96C. **The Major** *Required:* Computer Science 111, 118 (or Electrical and Computer Engineering 132B), M151B (or Electrical and Computer Engineering M116C), M152A (or Electrical and Computer Engineering M116L),180; Electrical and Computer Engineering 102, 110, 111L, 113; one course from Electrical and Computer Engineering 131A, Civil and Environmental Engineering 110, Mathematics 170A or Statistics 100A; 8 units of Electrical and Computer Engineering electives and 8 units of Computer Science electives from among upper division courses; 12 units TBA electives; 8 units capstone design from either Electrical and Computer Engineering 180DA/DB or 183DA/DB. For information on University and general education requirements, see Requirements for B.S. Degrees on page 21 or http://www.registrar.ucla.edu/ge/. **Suggested Tracks** *1. Networked Embedded Systems:* This track targets two related trends that have been a significant driver of computing, namely stand-alone embedded devices becoming networked	preparation for employment. **Preparation for the Major** *Required:* Computer Science 1 or Electrical Computer Engineering 1, Computer Science 31, 32, 33, 35L, M51A (or Electrical and Computer Engineering M16); Electrical and Computer Engineering 3, 10, 11L; Mathematics 31A, 31B, 32A, 32B, 33A, 33B, 61; Physics 1A, 1B, 1C, 4AL; Engineering 96C. **The Major** *Required:* Computer Science 111, 118 (or Electrical and Computer Engineering 132B), M151B (or Electrical and Computer Engineering M116C), M152A (or Electrical and Computer Engineering M116L),180; Electrical and Computer Engineering 102, 110, 111L, 113; one course from Electrical and Computer Engineering 131A, Civil and Environmental Engineering 110, Mathematics 170A or Statistics 100A; 8 units of Electrical and Computer Engineering electives and 8 units of Computer Science electives from among upper division courses; 12 units TBA electives; 8 units capstone design from either Electrical and Computer Engineering 180DA/DB or 183DA/DB. For information on University and general education requirements, see Requirements for B.S. Degrees on page 21 or http://www.registrar.ucla.edu/ge/. **Suggested Tracks** *1. Networked Embedded Systems:* This track targets two related trends that have been a

and coupled to physical systems, and the Internet evolving towards a network of "things" (the IoT). These may broadly be classified as cyber physical systems, and includes a broad category of systems such as smart buildings, autonomous vehicles, and robots, which interact with each other and other systems. This trend in turn is driving innovation both in the network technologies (new low-power wireless networks for connecting things, and new high-speed network and computing infrastructure to accommodate the transport and processing needs of the deluge of data resulting from continual sensing), and in embedded computing (new hardware and software stack catering to requirements such as ultra-low power operation, and embedded machine learning). Students pursuing this track are strongly encouraged to take Electrical and Computer Engineering/Computer Science M119 in junior year, and to choose three electives from courses such as Computer Science 130, 131, 132, 133, 136, 181, 188, Electrical and Computer Engineering 2, 115A, 115B, 115C, M117, 132A, 133A, 141, 142, 188. Students who pursue a technical breadth area in either Electrical and Computer Engineering or Computer Science can choose an additional three courses from this list. *2. Data Science:* This track targets the trend towards the disruptive impact on computing systems, both at the edge and in the cloud, of massive amounts of sensory data being collected, shared, processed, and used for decision making and control. Application domains such as health, transportation, energy etc. are being transformed by the abilities of	significant driver of computing, namely stand-alone embedded devices becoming networked and coupled to physical systems, and the Internet evolving towards a network of "things" (the IoT). These may broadly be classified as cyber physical systems, and includes a broad category of systems such as smart buildings, autonomous vehicles, and robots, which interact with each other and other systems. This trend in turn is driving innovation both in the network technologies (new low-power wireless networks for connecting things, and new high-speed network and computing infrastructure to accommodate the transport and processing needs of the deluge of data resulting from continual sensing), and in embedded computing (new hardware and software stack catering to requirements such as ultra-low power operation, and embedded machine learning). Students pursuing this track are strongly encouraged to take Electrical and Computer Engineering/Computer Science M119 in junior year, and to choose three electives from courses such as Computer Science 130, 131, 132, 133, 136, 181, 188, Electrical and Computer Engineering 2, 115A, 115B, 115C, M117, 132A, 133A, 141, 142, 188. Students who pursue a technical breadth area in either Electrical and Computer Engineering or Computer Science can choose an additional three courses from this list. *2. Data Science:* This track targets the trend towards the disruptive impact on computing systems, both at the edge and in the cloud, of massive amounts of sensory data being collected, shared, processed, and used for decision making and control. Application

inference-making and decision-making from sensory data that is pervasive, continual, and rich. This track will expose students to the entire data-to-decision pathway spanning the entire stack from hardware and software to algorithms, applications, and user experience. Students pursing this track are strongly advised to take Computer Science 143 and Electrical and Computer Engineering/Computer Science M146, and to additionally choose two electives from courses such as Computer Science CM121, 136, 144, 145, 161, 188, Electrical and Computer Engineering 114, 133A, 133B, 134, 188. Students who pursue a technical breadth area in either Electrical and Computer Engineering or Computer Science can choose an additional three courses from this list. Students are also free to design ad hoc tracks. The technical breadth area requirement provides an opportunity to combine elective courses in Electrical and Computer Engineering and Computer Science with those from another HSSEAS major to produce a specialization in an interdisciplinary domain. As noted above, students can also select a technical breadth area in either Electrical and Computer Engineering or Computer Science to deepen their knowledge in either discipline.	domains such as health, transportation, energy etc. are being transformed by the abilities of inference-making and decision-making from sensory data that is pervasive, continual, and rich. This track will expose students to the entire data-to-decision pathway spanning the entire stack from hardware and software to algorithms, applications, and user experience. Students pursing this track are strongly advised to take Computer Science 143 and Electrical and Computer Engineering/Computer Science M146, and to additionally choose two electives from courses such as Computer Science CM121, 136, 144, 145, 161, 188, Electrical and Computer Engineering 114, 133A, 133B, 134, 188. Students who pursue a technical breadth area in either Electrical and Computer Engineering or Computer Science can choose an additional three courses from this list. Students are also free to design ad hoc tracks. The technical breadth area requirement provides an opportunity to combine elective courses in Electrical and Computer Engineering and Computer Science with those from another HSSEAS major to produce a specialization in an interdisciplinary domain. As noted above, students can also select a technical breadth area in either Electrical and Computer Engineering or Computer Science to deepen their knowledge in either discipline.