



***4th Carnegie Mellon Conference on the
Electricity Industry
FUTURE ENERGY SYSTEMS:
EFFICIENCY, SECURITY, CONTROL***

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A Modern Electric Energy Systems Curriculum

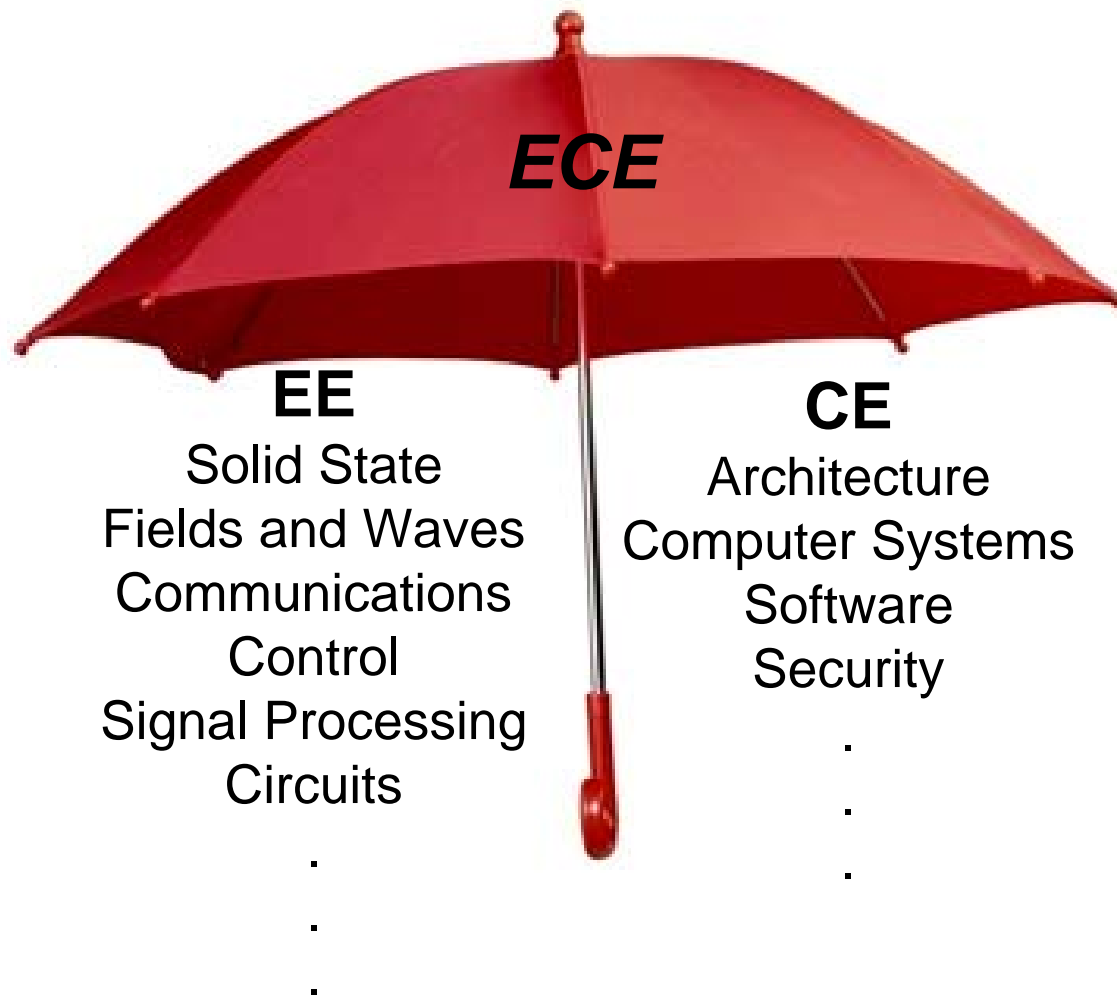
- *Why ECE at Carnegie Mellon?*
- *What are we doing already?*



Electrical and Computer Engineering (ECE)

- ***Despite the large number of “electrical and computer engineering” and similarly named departments at US universities, there are currently only 14 universities offering accredited BS degrees in Electrical and Computer Engineering.***
- ***Most universities continue to have separate BS degree programs in Electrical Engineering (268) and Computer Engineering or Computer Systems Engineering (165)***
- ***Our university introduced the BS in ECE as a single degree over 15 years ago.***

The Traditional View



A Modern View



Sensor Networks
Embedded Systems
IC Manufacturing
Energy Systems
Wireless Communications

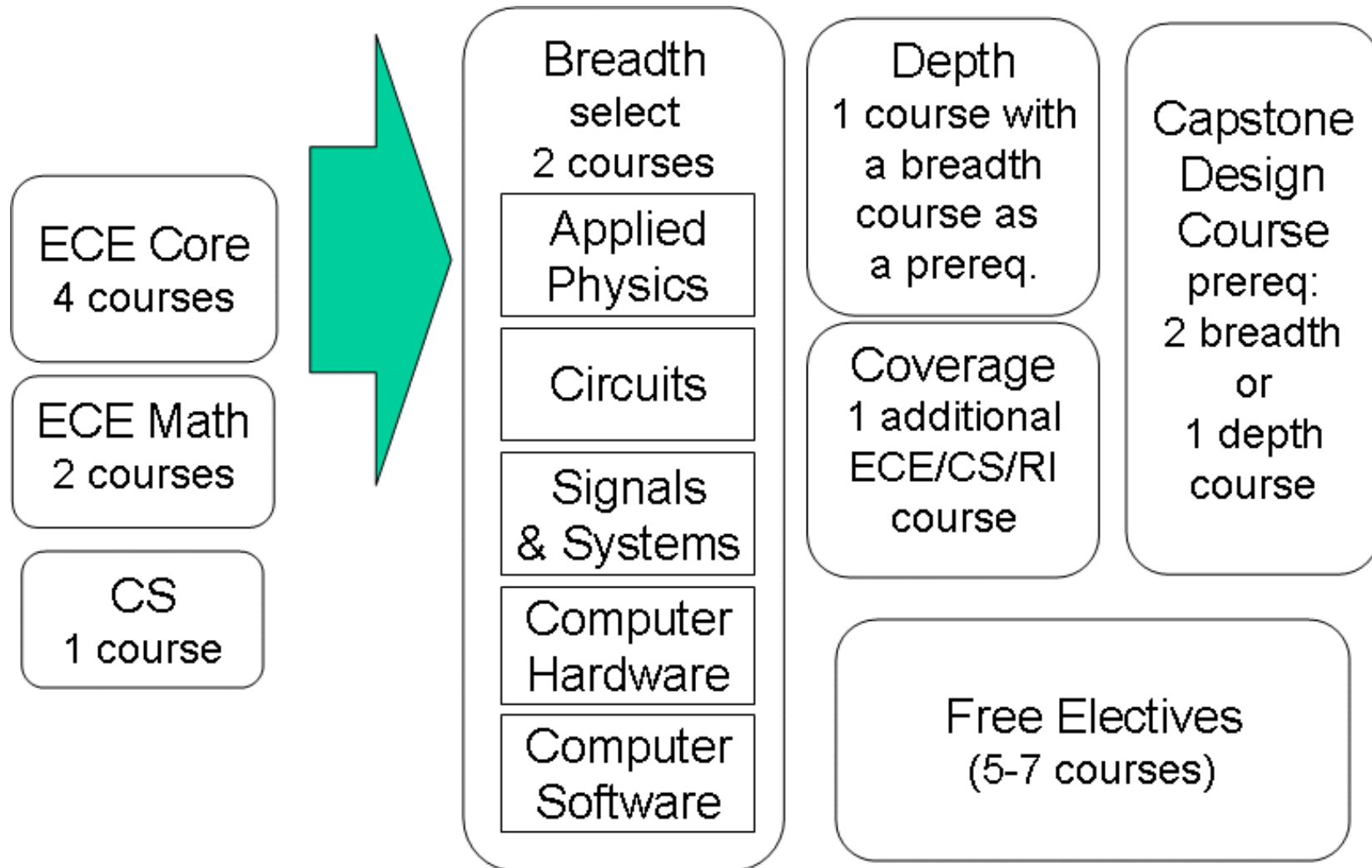
ECE as a Unified Discipline

- ***The evolution of the field of electrical and computer engineering demands a new breed of ECE graduates with a broad set of competencies that cannot be classified into “EE” and “CE”.***
- ***The core requirements should assure students have a foundation in a set of essential concepts and skills for an ECE career.***
- ***The breadth, coverage, depth and capstone design requirements should assure students have a sufficiently rich ECE education.***
- ***The number of free electives should be sufficient to encourage students to:***
 - *specialize deeply in a particular area of ECE; OR*
 - *become broadly educated in a number of areas of ECE; OR*
 - *complement their ECE experience with education in another field (e.g., biomedical engineering, public policy, computer science, business, life sciences, humanities, music, etc.).*

Core ECE Courses

- **18-100: Introduction to Electrical and Computer Engineering**
 - *Provides an overview of the field of ECE and introduces some of the fundamental tools needed to solve problems in this field.*
- **18-220: Fundamentals of ECE: Devices and Circuits**
 - *Provides an introduction to semiconductor devices and circuit analysis with links to digital electronics and signal processing.*
- **18-240: Fundamentals of ECE: Structure and Design of Digital Systems**
 - *Provides a foundation and working knowledge in the application, operation and implementation of digital systems.*
- **18-290: Fundamentals of ECE: Signal & Information Processing**
 - *Provides mathematical and computational tools for processing signals and information.*
- **15-213: Fundamentals of ECE: Introduction to Computer Systems**
 - *Provides concepts underlying how programs are executed on computer systems*

Course Selection and Structure



Electric Energy Systems Group (EESG)

- ***The [Electric Energy Systems Group \(EESG\)](http://www.eesg.ece.cmu.edu) (www.eesg.ece.cmu.edu) is a group of faculty, researchers, and graduate students actively pursuing creation of a curriculum, research programs, a software laboratory, and an outreach program for modern electric energy systems.***

ECE Education in Electric Energy Systems

- ***The objective is to prepare engineers for leadership and having impact in academia and industry including those which are developing electric energy distributions to homes, aircrafts, cars, ships, spacecraft, etc.***
- ***Three new course developed (18-418; 18-875; and 18-777).***
- ***See <http://www.ece.cmu.edu/~nsf-education> for courses offered.***

Courses Specific to this Area

- **18-418: Electric Energy Processing: Fundamentals and Applications**
 - *poster presenting the vision for this course.*
- **18-875: Engineering and Economics for the Changing Electricity Industry**
 - *jointly offered at CIT and Tepper. Professors Lester Lave, Tepper and Marija Ilic (CIT-ECE and EPP). The course supported by the CMU educational software --Interactive Power System Simulator (IPSYS—poster at the conference).*
- **18-777: Large-scale Dynamic Systems**
 - *Modeling, analysis and control methods for many complex systems, including future electric energy systems. Professor Ilic greatly acknowledges Professor Mo Jamshidi (with us today) who has shared his vision.*

Conclusion

- ***We view Electrical and Computer Engineering as a unified discipline***
- ***Our curriculum provides;***
 - *fundamentals, depth and breadth*
 - *great flexibility and choice for students*
- ***Course offerings in the specific area of energy systems***
- ***Uniquely positioned to train students for leadership and impact in this field.***
- ***ECE and CIT are committed to actively creating a modern electric energy systems program***