### CE Senior Elective Courses

- **ECE 122A**  VLSI Principles
- **ECE 122B**  VLSI Architecture and Design
- **ECE 123**  High-Performance Digital Circuit Design
- **ECE 153A**  The Hardware/Software Interface
- **ECE 153B**  Sensor and Peripheral Interface Design
- **ECE 154A**  Introduction to Computer Architecture
- **ECE 154B**  Advanced Computer Architecture
- **ECE 157A**  Machine Learning in Design/Test Automation
- **ECE 157B**  Artificial Intelligence in Design/Test Automation
- **ECE 189A-189B-189C**  Computer Engineering Project (Senior Capstone)

### CE Senior Elective Track Courses

- **Very Large Scale Integration (VLSI)**  ECE 123/122A or 122A/B
- **Embedded Systems Design**  ECE 153A/B
- **Computer Architecture**  ECE 154A/B
- **Design and Test Automation**  ECE 157A/B
- **Capstone Design Project**  ECE 189A/B/C
## ECE 123/122B or 122A/B

**Very Large Scale Integration**

- Modern VLSI design of integrated circuits
  - Architectural and circuit design issues and constraints for high-performance, low-power, large-scale systems
  - Field effect transistors, layout rules, parasitics, pin limitations, noise and crosstalk, clock and power distribution
- Practical issues in integrated circuit design
  - Noise/Crosstalk/EMI, variability and yield

## ECE 153 A/B

**Embedded Systems Design**

- Technology from which modern embedded digital computer systems are built
  - Real time programming
  - Modal and reactive systems
- Major hardware/software components, design issues, implementation mechanisms, and interfaces between components
  - Hardware/software interface
  - Sensor and peripheral interface
ECE 154 A/B
Computer Architecture

- ECE 154A: Introduction to Computer Architecture
- ECE 154B: Advanced Computer Architecture
  - Topics include computer architectures with various types (data-, task-, instruction level) of parallelism and memory systems design.

ECE 157 A/B
Design and Test Automation

- Hardware design and verification through use of software tools: applying machine learning for data analytics in hardware design and verification process
- Design workflows to model engineering processes in hardware test and verification: capturing human perception in an engineering workflow with AI approaches
ECE 189 A/B/C
Computer Engineering Project

• Design and implementation of a complete digital system including both hardware and software
  – ECE 189A (Fall) – Project definition, high-level system requirements, detailed system design, ready for manufacture
  – ECE 189B (Winter)- Printed circuit boards (PCB) are fabricated and assembled. Focus shifts to software development on a development kit
  – ECE 189C (Spring) – Final assembly, debugging, verification, subsystem and system integration, final presentation