Are you curious about how computer chips work?  
...how they are manufactured?  
...how they are designed?

In 1958, Jack Kilby at Texas Instruments built the first integrated circuit flip-flop with two transistors. Today, the Pentium 4 microprocessor contains 55 million transistors while a 512-Mbit dynamic access memory chip contains over 500 million transistors. This number has increased 53% per year for the past 45 years. No other technology in history has sustained such a high growth rate for so long. In 2003, the semiconductor industry manufactured more than one quintillion ($10^{18}$) transistors, which is more than 100 million for every human being on the planet. In this year, the industry produced $200 billion in sales.

This course will begin by presenting students will the fundamentals in integrated circuit technology, including how this technology works, how such circuits are manufactured, and how their behaviors are modeled in the face of changing physical phenomena resulting from chip feature sizes shrinking to only a handful of atoms wide.

Next, the course will change pace in order to address the most important issue today in integrated circuit design:

How is it possible to manage the complexity of designing, verifying, and characterizing any system that contains tens of millions, hundreds of millions, and soon BILLIONS of tightly-coupled, inter-operating devices?

This seemingly intractable problem is attacked with ELECTRONIC DESIGN AUTOMATION, where sophisticated computer-aided design tools are used to hierarchically design a system from the top-down: from high-level logic behavior (captured with high-level description languages), down to a set of masks that are used to grow nano-scale devices on a 1 cm$^2$ slice of silicon.

The tools we will use in class are the very same, powerful, state-of-the-art industrial design tools that are used by the largest semiconductor companies in the world. By the end of the term, student designs will be sent to AMI Semiconductor (NASDAQ: AMIS) for fabrication and packaging.

Course Overview:
Part 1: Fundamentals of VLSI design
Part 2: Students design their custom cell library, the basic digital logic building blocks for their designs
Part 3: Students will couple their cell library to design automation tools to produce a complete system-on-a-chip using the most current, cutting-edge design methodologies in the design automation industry.