ECE 6444 – Silicon-Based Heterostructure Devices and Circuits

Topical Outline

Introduction
- historical perspective
- application-induced device design constraints
- bandgap engineering in the Si material system
- SiGe vs III-V vs Si
- the state-of-the-art

Epitaxial SiGe Alloys
- strained-layer epitaxy
- stability constraints
- growth techniques
- band structure and band alignments
- carrier transport properties

The SiGe Heterojunction Bipolar Transistor (SiGe HBT)
- a review of Si BJT device physics
- device fabrication and structural design
- process integration issues with CMOS
- dc and ac properties
- second-order device phenomena
- temperature effects

Circuit Design with SiGe HBTs
- application-driven profile optimization
- low-frequency noise
- broadband noise
- linearity
- compact modeling issues
- design example: a SiGe HBT LNA

Other Si-Based Heterostructure Devices
- SiGe-channel FETs
- strained-Si CMOS
- SiGe-based resonant tunneling devices
- SiGe-based optoelectronics devices

Future Directions