ECE 594A
INTRODUCTION TO NANOELECTRONICS
LECTURE 1

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OUTLINE

• Week 1: March 29/31
  – Current Status of Microelectronics
  – Is Nanoelectronics the Future?
    Reading:
    - Chapter 1 of Text
    - *There is Plenty of Room at the Bottom*, R. P. Feynman, APS Meeting, Dec. 1959.
    - ITRS Latest Edition

• Week 2: April 5/7 (Basic Quantum Phenomena)
  – Waves, particles, wave-particle duality
  – Wave mechanics: Schrodinger’s equation, potential wells, harmonic oscillator
  – Reflection, transmission and tunneling
  – Atoms and atomic orbitals
    Reading:
    - Chapter 2 and 3 of Text
OUTLINE

• **Week 3: April 12/14 (Basics of Nanoelectronic Materials)**
  – Semiconductors: crystal lattices, bonding, energy bands
  – Materials for Nanoelectronics
  – Semiconductor heterostructures
  – Low dimensional structures

  *Reading:*
  - Chapter 4 of Text

• **Week 4 and 5: (Nanoscale Transport)**
  – Electron transport in Nanostructures
  – Thermal transport in Nanostructures
  – Transport models and simulation techniques

  *Reading:*
  - Chapter 6 and 7 of Text
OUTLINE

- **Week 6: May 3, 5 (Carbon Nanomaterials)**
  - Graphene and carbon nanotubes
  
  *Reading:*
  - Chapter 4 of Text

- **Week 7 and 8: (Nanofabrication and Characterization Techniques)**
  - Nanofabrication principles
  - Techniques using photons, charged beams, scanning probes, replication, pattern transfer etc
  - Indirect nanofabrication
  - Bottom-up techniques: growth, self-assembly etc
  - Nano characterization: Raman, XPS, AFM, TEM, SEM etc

  *Reading:*
  - Chapter 5 of Text
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• Week 9 May 24, 26 (Applications-1)
  – Active Electronic Devices: FETs, TFETs, RTD, SET etc
  – Novel interconnects and passives

  Reading:
  - Chapter 8 of Text

• Week 10: May 31, June 2 (Applications-2)
  – Energy conversion: and storage: photovoltaics, Other natural energy sources
  – Energy conversion: and storage: thermoelectrics, battery
  – NEMS

  Reading:
  - Chapter 8 of Text