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

OUTLINE

- **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