EEE 434 Quantum Mechanics for Engineers (3) [F]

Course (Catalog) Description:
Angular momentum, wave packets, Schroedinger wave equation, probability, problems in one dimension, principles of wave mechanics, scattering, tunneling, central forces, angular momentum, hydrogen atom, perturbation theory, variational techniques.
Lecture, Course Type: Technical Elective.

Prerequisites:
EEE 241; EEE 352.

Textbook:
D. Ferry, *Quantum Mechanics: An Introduction for Device Physicists and Electrical Engineers*, Institute of Physics Publishing, 1995.

Supplemental Materials: None.

Coordinator:
D. Vasileska, Assistant Professor

Prerequisites by Topic:
1. Classical wave phenomena
2. Ordinary differential equation
3. Partial differential equation
4. Complex algebra
5. Fourier analysis
6. Maxwell’s equations
7. Electromagnetic waves

Course Objective:
1. Students are conversant with the concepts of quantum mechanics as they apply to semiconductors and semiconductor devices

Course Outcome:
1. Students are conversant with the major postulates that arise in quantum mechanics, the Schrödinger equation and its applications to situations encountered in microelectronic devices

Course Topics:
1. Historical orientation
2. Waves, Fourier transforms, and Wave Packets
3. Schroedinger equation
4. Interpretation of wave function and probabilities
5. Operators and their expectation values
6. Uncertainty principle
7. Piecewise constant potentials in one dimension

8. Tunneling and tunnel diodes
9. WKB approximation
10. Harmonic oscillator.Central forces and angular momentum
11. Perturbation theory
12. Variational techniques

Computer Usage:
Use of contemporary simulation tools as applied to realistic device structures; integrated in homework.

Laboratory Experiments: None.

Course Contribution to Engineering Science and Design:
This course will introduce students to the basic concepts of quantum mechanics as applied to real semiconductor device structures. An example includes understanding the operation of double-barrier structure used in resonant tunneling diodes.

Course Relationship to Program Outcomes:
a: There is significant math, science and engineering background taught in the lectures.
k: The students are exposed to contemporary simulation tools as applied to realistic device structures, they are able to define a problem and recognize the appropriate solution. They are also able to appropriately apply modern computer-based analysis tools.

Person preparing this description and date of preparation: Dragica Vasileska-Kafedziska, K. Tsakalis, Apr. 2009, June 2015.