ELEC 7760/7767 – SILICON-BASED HETEROSTRUCTURE DEVICES AND CIRCUITS

Proposed Catalog Data: ELEC 7760/7767. SILICON-BASED HETEROSTRUCTURE DEVICES AND CIRCUITS (3) LEC. 3. Pr., ELEC 5700/6700 or consent of instructor. Bandgap engineering, strained SiGe and Si, SiGe BiCMOS technology, noise, linearity, circuits applications.


Coordinator: G. Niu, Professor of Electrical & Computer Engineering.

Course Objectives:
1. To understand concepts of bandgap engineering.
2. To understand material growth of Si heterostructures.
3. To understand and design SiGe transistors for RF, analog and mixed-signal applications.
4. To learn the basic techniques of low-noise circuit design using SiGe transistors.

Prerequisites by topic:
1. Linear circuit analysis;
2. Electrical characteristics of transistors;
3. PN junctions;

Topics:
1. Overview of the field (2 classes)
2. SiGe strained layer epitaxy (3 classes)
3. SiGe HBT BiCMOS Technology (7 classes)
4. dc and ac characteristics of SiGe HBTs (8 classes)
5. Higher order effects (6 classes)
6. Noise and linearity (6 classes)
7. Temperature effects and radiation effects (6 classes)
8. Strained Si CMOS (5 classes)
9. Optoelectronics applications (2 classes)

Typical methods for evaluating student performance:

Homework 30%
Projects 40%
Final exam 30%
Justification for Graduate Credit:
The material in this course is beyond the scope of what is typically presented in undergraduate electrical and computer engineering programs.

Computer usage:
Several assignments will familiarize the students with the basics of heterostructure device design using computer simulation tools.

Class attendance:
Class attendance and its effect on course grade is the prerogative of the individual instructor and will be part of the course outline and announced the first day of class.

Policy on unannounced quizzes:
Unannounced quizzes and their effect on course grade are the prerogative of the individual instructor and will be part of the course outline and announced the first day of class.

Special accommodations:
Students who need special accommodations should make an appointment to discuss their needs as soon as possible.

Contribution of course to meeting the professional component
   Engineering topics: 3 credits
       83% engineering science (2.5 credits)
       17% engineering design (0.5 credits)

Primary program outcomes related to this course:
   Outcome 1. Ability to apply knowledge of math, science and engineering to solve problems
   Outcome 2. Ability to apply in-depth knowledge in one or more disciplines
   Outcome 3. Ability to design an electrical component or system to meet desired needs
   Outcome 6. Proficiency in the use of computers and other modern tools to solve engineering problems
   Outcome 8. Proficiency in communicating ideas and information orally and in writing

Prepared by: Guofu Niu                  Date: 1/17/2007