EEE 6328  Semiconductor Physical Electronics

1. **Catalog Description** (3 credit hours) - Crystal structure and symmetry; carrier statistics; lattice dynamics; energy band theory; equilibrium properties of semiconductors; recombination-generation and trapping processes; electronic transport phenomena; scattering mechanisms; optical properties.

2. **Pre-requisites and Co-requisites** - EEE 5426 (EEE 4420) Introduction to Nanodevices or equivalent or consent by instructor. *There will be some review as needed.*

3. **Course Objectives** - The objective of this course is to provide first year graduate students with a comprehensive coverage of semiconductor physics that is essential to the understanding of the fundamental operation principles of a wide variety of semiconductor devices. Note that the emphasis in this class is on *semiconductor* physics, not *device* physics which is covered in EEE 6397. There is minimal overlap between these two courses.

4. **Instructor** - Gijs Bosman
   a. Office location: NEB 565
   b. Telephone:
   c. E-mail address: bosman@ece.ufl.edu
   d. Web site: http://www.bosman.ece.ufl.edu
   e. Office hours: M-W-F 11:00-noon in NEB 565

5. **Teaching Assistant**
   a. Office location: NA
   b. Telephone: NA
   c. E-mail address: NA
   d. Office hours: NA

6. **Meeting Times** - M-W-F, period 8, 3-3:50 pm in Ben 328

7. **Class/laboratory schedule** – three 50-minute sessions per week.

8. **Meeting Location** - Ben 328

9. **Material and Supply Fees** – NA

10. **Textbooks and Software Required**
    a. Title: The Physics of Semiconductors: with applications to optoelectronic devices
    b. Author: Kevin F. Brennan
    c. Publication date and edition: 1999
    d. ISBN number: 0-521-59662-9

11. **Recommended Reading** (many good textbooks exist, below is a sample)
    a. Title: Introduction to Solid-State Physics
    b. Author: Charles Kittel
12. **Course Outline** -
- Lattice dynamics and phonon spectrum with emphasis on hot phonons to address, for example, energy efficiency in advanced solar cells.
- Semiconductor statistics and electronic noise with emphasis on low noise device engineering.
- Energy band theory: 1-D, 2-D, and 3-D systems.
- Macroscopic carrier transport phenomena in semiconductors with a Monte-Carlo focus on hot carrier drift and diffusion as observed in advanced FETS and BJTs.
- Mesoscopic carrier transport phenomena in low dimensional semiconductors such as observed in carbon nanotubes and graphene sheets.
- Recombination mechanisms and excess carrier phenomena as they effect noise and leakage currents in electronic devices and efficiencies of solar cells.
- Optical processes in semiconductors such as optical generation, radiative recombination and stimulated emission.

13. **Attendance and Expectations** - It is understood that all attendees will be focused on the lecture and will take every possible measure to minimize distractions for everyone (i.e. no newspapers, no cell phones, no PDAs, no iPODs, no laptops, etc. unless instructed to use them for class, no newspapers, yes on-time attendance, and no early departures (unless noted and approved in advance)).

14. **Grading** - homework (25%), midterm (25%), term paper (25%), and final exam (25%).
- Homework includes class participation in active learning.
- Midterm date: Feb 29 in class.
- Final exam date: May 3, 5:30-7:30 pm in Ben328.

15. **Grading Scale** - The overall class average will approximately determine the B/B+ breakpoint. The A range will start approximately one standard deviation above this point, the C- range approximately one standard deviation below.

“In order to graduate, graduate students must have an overall GPA and an upper-division GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:
http://gradschool.ufl.edu/catalog/current-catalog/catalog-general-regulations.html#grades

16. **Make-up Exam Policy** - Makeup exam is contingent on appropriate justifications and legal documents (UF Dean of Students, certified physician, military active duty, judge for jury duty, etc.)

17. **Honesty Policy** – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action.
This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

18. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

19. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
   - University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.
   - SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.
   - Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling.
   - Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

20. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.