Course Number: EE 496
Course Title: Introduction to Semiconductor Device Theory
Semester Offered: Fall 2006
Instructor: Deuk Heo
10th Day Enrollment: 14
Number Completing Successfully (C grade or better): 14

I. Assessment Outcomes from the Course Syllabus

☒ (A) Ability to apply knowledge of mathematics, science and engineering.
☐ (B) Ability to design and conduct experiments as well as analyze and interpret data.
☒ (C) Ability to design a system, component, or process to meet desired needs.
☐ (D) Ability to function on multidisciplinary teams.
☐ (E) Ability to identify, formulate, and solve engineering problems.
☐ (F) An understanding of professional and ethical responsibility.
☒ (G) Ability to communicate effectively in written and oral formats.
☐ (H) A broad education necessary to understand the impact of engineering solutions in global, economic, and societal context.
☐ (I) Recognize the need for, and have the ability to engage in life long learning.
☐ (J) Have a broad education and knowledge of contemporary issues.
☒ (K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.

II. List of Course Topics from the Course Syllabus

1. Introduction to microelectronic devices
2. Atoms and electrons
3. Energy bands and charge carriers
4. Statistical device analysis such as Monte Carlo Analysis
5. Excess charge carriers
6. pn Junction diode
7. JFET and MOSFET including short channel effect
8. Bipolar junction transistor
9. Optoelectronic Devices
10. Hetero-junction Bipolar Transistor
11. Integrated Circuit including CMOS

III. Course Assessment Summary Table: one row of the table should be devoted to each of the checked outcomes in part I.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Topics</th>
<th>Specific Measures (Samples should be available in the course materials file for inspection.)</th>
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</table>
IV. Using the table as a guide, for each outcome summarize your evaluation of the students’ achievement of that outcome; cite student performance on the identified measures as evidence to support your conclusions.

(A) Ability to apply knowledge of mathematics, science and engineering.
Most of the homeworks quizzes and exams measured this ability, so I feel the final grade can be a reasonable measure of this outcome. There were five (5) “A”, two (2) “A-”, one (1) “B+”, four (4) “B”, one (1) “B-”, and one (1) “C+” grades. The students did quite well in their application of basic science and math to semiconductor device engineering problems. Most of students were well prepared for following up the lectures, and solving homework assignments. Homework and exams were designed for measuring this ability and the grade showed this class satisfies the requirement of ABET 3(A) which is an ability to apply knowledge of mathematics, science, and engineering.

(C) Ability to design a system, component, or process to meet desired needs.
Throughout the course, students were exposed to the device parameter analysis for overall performance of device such as Diode, FET, BJT, and optoelectronic devices. My observation of criteria3(C) is based on exams and homework assignments to analyze the device parameters to predict the performance of semiconductor devices. Most of the students could understand device parameters, device function and device architectures. In addition to that, students could understand which parameter will affect speed, conductivity, mobility, and current etc. In addition, students could understand the device fabrication process and the process of integrated circuits on silicon wafer.

(G) Ability to communicate effectively in written and oral formats.
In the class, Q&A session was assigned in the last five minutes of the class. During the Q&A session, students are encouraged to ask and answer any technical questions to provide them a chance to participate the learning process. Homeworks were used to check their communication skill in written formats. The homework assignment is for the summary of the modern semiconductor device technologies such as short channel effects of FET devices and Hetrojunction Bipolar Devices. Most of students have good written and oral communication skills.

(K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.
In homework assignments, students were required to use a modern simulation tool such as Matlab and to understand a device simulation method such as Monte Carlo Simulation for the device parameter analysis. Most of the students demonstrated an ability to use techniques, skills
and modern engineering tools necessary for engineering practices. The rest required some help from me to perform the simulation and analysis of the device parameter analysis.

V. Qualitative Assessment of Student Performance: using the arguments above and other data support the claim that students who completed this course with a grade of C or better have achieved each of the intended outcomes of this course.

The class started with 14 students and 14 students took the final examination. Weekly homework assignments were given to students on Friday class and the homework due was the following Friday. Three midterm examinations and final examination were given to students in the semester. The attendance in the class was usually more than 90%. Weekly office hours were assigned to help students who might have questions about homework assignments and exams. The final examination was used as an assessment tool of student’s performance. The highest score was 92.6, the average score was 85.9, the lowest score was 74.2, and the standard deviation was 5.7. Most of students were well prepared for following up the lectures, and solving homework assignments.

VI. Concerns: state any concerns you may hold about this class – were the students adequately prepared coming into it? Are there topics or outcomes where (some) students were weak after completing the course? Other concerns? Were there any comments on students’ course evaluations that should be addressed in future instances of the course? This section is very important for improving our program: it provides critical input to the curriculum committee for identifying areas requiring attention.

In Fall 2006, some students have fundamental concepts for the physics and semiconductor materials. However, most of students do not have any fundamental knowledge of them. Within the first two weeks it was necessary to equip students with those concepts for EE496 lecture and homework assignments. It is also recommended that more device performance analysis based on Matlab could be more helpful for students to understand the important concepts of device physics. In addition to that, it is recommended to teach the fundamentals of modern device technologies such as nano devices.

Signature __________________________________________ Date: _______________________

Please email a copy of the completed form to Patricia Arnold, patricia@eecs.wsu.edu and deliver a signed hardcopy to her mailbox.