Washington State University
School of EECS
Electrical Engineering Course Assessment Report

Course Number       EE 496
Course Title        Introduction to Semiconductor Device Theory
Semester Offered    Fall 2005
Instructor          Byron Brenden
10^th Day Enrollment 2
Number Completing Successfully (C grade or better) 2

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
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</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Ability to apply knowledge of mathematics, science and engineering.</td>
<td>1 - 11</td>
<td>Course grade</td>
</tr>
<tr>
<td>(C) Ability to design a system, component, or process to meet desired needs.</td>
<td>1 - 11</td>
<td>Homework problems 6.11, 6.15, 6.25</td>
</tr>
<tr>
<td>(G) Ability to communicate effectively in written and oral formats.</td>
<td>1 - 11</td>
<td>In-class discussion, homeworks</td>
</tr>
<tr>
<td>(K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.</td>
<td>1 - 11</td>
<td>Homework problems 7.1, 7.3</td>
</tr>
</tbody>
</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.**

All of the homeworks and exams measured this ability, so I feel the course grade is a reasonable measure of this outcome. The two grades were “A” and “B-.” The “A” student (an MSE student) did an outstanding job while the “B-” student’s performance was adequate.

(C) **Ability to design a system, component, or process to meet desired needs.**

I chose three homework problems to measure this outcome. In problem 6.11 students had to calculate the B-dose required to achieve a given threshold voltage in a MOSFET. In problem 6.15 students had to determine the oxide thickness and substrate doping to achieve a specified capacitance vs. gate bias for a Si MOS capacitor. In problem 6.25 students had to determine implant parameters required to lower the threshold voltage of a MOSFET by 2 V. Based on their results I conclude that both students met this objective.

(G) **Ability to communicate effectively in written and oral formats.**

This was a very small class (two students) so there was plenty of time for each student to interact with the instructor during each class period. This allowed me to determine that both students had good oral communication skills. Student homework assignments were kept in binders so that all assignments could be viewed as a whole at the end of the
course. Using these written assignments as a measure, I found that both students were able to communicate effectively in writing.

(K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.

I chose these two specific homework problems as examples of problems where student needed to use a computer tool to generate numerical and graphical solutions to problems. Both were able to successfully complete these problems at (at least) a minimally acceptable level of correctness.

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.

Overall the two students were able to effectively demonstrate achievement of the four outcomes relevant to this course. Not only did they all receive better than C grades, but were all able to successfully complete homework assignments that specifically measured outcomes (C) and (K).

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.

Outcome (G) “Ability to communicate effectively in written and oral formats” is probably not that well measured by traditional lecture courses such as this and would be better accessed in laboratory or design courses which has specific writing and/or presentation components.

Signature: Byron Brenden Date: 2007-05-11

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