Course Description: This course is about basic semiconductor physics and the physics of three important devices: 1) the PN junction, 2) the bipolar junction transistor (BJT), and 3) the metal-oxide-semiconductor field-effect transistor (MOSFET). The course is divided into three parts. The first part is an introduction to quantum mechanics and solid-state physics (energy bands, electrons and holes, the Fermi function, etc.), doping and carrier densities, carrier transport and generation-recombination, and the so-called semiconductor equations, which provide a complete, semi-classical, mathematical description of electrons and holes in semiconductors, subject to some important simplifying assumptions. The second part of the course applies these concepts to PN junctions and bipolar junction transistors (BJTs), and the third part treats the dominant electronic device today, the metal-oxide-semiconductor field-effect transistor (MOSFET).

The course covers a lot of ground, but it provides a basic understanding of semiconductors and devices, for those interested in circuits and applications, and a starting point for further studies, for those who intend to focus on electronic materials and devices.

Instructor: M.S. Lundstrom (lundstro@purdue.edu)

TA: John Wilcox (jrwilcox@purdue.edu)

Class meetings: Tuesday, Thursday 4:30 – 5:45 PM EE-115
(Lectures will be posted for viewing on nanoHUB.org)

Office Hours: Mon, Wed., Fri., 9:30-10:30 AM, EE-334C
(or make an appointment for a different time by e-mail.)

Prerequisites: Basic EE background in circuits and devices, and an undergraduate level understanding of physics and chemistry. ECE-305 is helpful, but not required. Prior acquaintance with quantum mechanics and solid-state physics is also helpful, but not required.

Texts: Advanced Semiconductor Fundamentals, 2nd Edition (ASF)

Semiconductor Device Fundamentals, 2nd Edition (SDF)
ISBN-0-201-54393-1

Handouts and class notes will also be distributed from time to time

Course Web Page: All course-related materials – lectures, HW assignments and solutions, course announcements and supplementary materials, etc. will be available on the course web page http://nanohub.org/groups/ece606lundstrom
Check it frequently.
Course Format: This course will be taught in a “flipped” format. Students will view lectures online – before class sessions, and class sessions will be used to amplify upon (not repeat) the lectures, to answer questions, and to work problems. More information on the course format and tips for taking the course are posted on the course web page.

Lecture Quizzes: There will be a quiz for each of the online lectures. The first four questions will be multiple choice and will focus on the few, key points that you should take away from the lecture. The last question will ask you to ask me one or more questions about the lecture. You must hand in the quizzes for the lectures assigned each week to Ms. Wanda Dallinger, EE-326, by 4:30 PM each Friday. Answers to quizzes will be posted Friday evenings. Quizzes will be graded pass/fail and up to two may be dropped when determining the final quizzes grade.

Homework Assignments: Working homework problems is essential for understanding a course like this. Homework will not be graded, but solutions will be posted and discussed in class.

Exams: Frequent exams will test your understanding of the material, so it will be important to keep up. Six (6) exams will be given. Exams will be conducted on Thursdays of Weeks 3, 6, 9, 12, 15 and during Finals Week. Your exam score will be determined by the highest 5 of the exams. You will have an opportunity to re-take one exam, and the highest of the first and second taking will be your score for that exam.

Grading:

Lecture quizzes and questions: 25%
Exams (5 at 15% each) 75%

The quiz score is computed as Score = x/total times 25%, where x is the number of quizzes you turned in and passed and total is the total number of lectures in the course.

The exam score is computed as Score = average of the percentage scores of the 5/6 best exams scores including any retake.

Approximate curve:

A: 91 – 100%
B: 81 – 90%
C: 71 – 80%
D: 61 – 70%
F: 60% or less

Academic Dishonesty: Any case of academic dishonesty will result in a grade of F in this course.

Class Attendance: Class attendance is important. If you must miss class, you are responsible for any material, information, handouts, announcements, etc. that you missed.

Campus Closing / Disruption of Classes: In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. In such an event, information about changes will be posted on the course web page and available from lundstro@purdue.edu

Course announcements posted on the course web page supersede prior written information.