Engineering Design with Discrete Semi-Conductors

Age/Grade Level(s): High School

Subject Area(s): Electronics

Time Allotted: 9x70

**Rationale:**

This course in Electronics is being taught as an applied science course. It is an explicit goal of this course to begin to develop engineering skills in the context of electronics. Within the context of science education, engineering is intimately and inextricably linked to science to the point that many scientists practice engineering and many engineers practice science. Engineering Design is a major element in the Oregon Science Standards and is slated to become a significant set of skills and concepts in the coming national Common Core Curriculum Standards.

Students have entered this course with very little to no background in either electronics or engineering process skills, as was discovered through the course and unit pre-assessments. It has been the goal of this course, from the beginning, to build knowledge and skills by teaching electronics from first principles; building knowledge and skills from the most basic concepts, components, and phenomena. Instruction has been offered through short lectures followed by significant opportunities for students to practice and apply their developing understanding through problem solving activities that range from highly guided to open ended. Further, the design of these activities has been informed by Engineering Design practices as outlined in the Oregon State Science Standards and the Oregon Engineering Design Work Sample Scoring Guide.

The importance and rationale for covering the use and applications of semi-conductor devices in this unit is as follows: Historically, though some basic understanding of electrical phenomena and some wide spread use of electrical technology existed prior to the discovery of semi-conducting materials, the applied art of Electronics began with the advent of early crystal diode semi-conductor based radio detectors. In fact, the term “electronics” itself was coined during the development of this technology. Since their discovery in the late 19th Century, semi-conductor electronics have changed how people live their lives. From radio telecommunication to the ever expanding use of personal electronic devices, semi-conductors are at the root of and are found in almost every example of modern technology.

This unit is designed to introduce students to some of the history of semi-conductors, offer some theory on the function of semi-conductors, and provide students with opportunities to explore the application of these devices through circuit construction, testing, and problem solving using modern solid state semi-conductor components: diodes, transistors, and Operational Amplifier (op-amp) Integrated Circuits (IC).