Introduction

[00:00:01.03] Hello, my name is Kaitlyn Casimo, and I'll be your primary instructor for this, an Introduction to Neural Engineering, sponsored by the University of Washington math science Upward Bound and the University of Washington Center for Sensorimotor Neural Engineering. This course was originally offered in person to rising high school juniors and seniors at the math science Upward Bound program at the University of Washington in the summer of 2016 and again in the summer of 2017. All of the components of the in-person version of this course are here in the online version of the courses as well.

[00:00:37.78] The online version of the course can be broken down into several segments. First, and most importantly, is the video lectures. Most of these will be given by me, but we'll also have some guest instructors who you'll meet later in the course. The in-person version of the course, the students completed weekly homework assignments. The grading rubrics for these assignments, as well as some sample assignments that would have received the perfect score, are posted on the online version.

[00:01:07.51] We've completed several lab activities in this course. Instructions for how to do these yourself, a write up, how to do a write up and some sample write ups that would have received a perfect score are also posted. There were two exams in this class, a vocabulary quiz given at the end of the neuroscience unit, which covers a neuroscience specific vocabulary that is needed for neural engineering, and a final exam that was comprehensive and given at the end of the course.

[00:01:36.12] The students also completed a final project where they evaluated a neural engineering system or device in-depth and reported on current research, research needs, the users and other challenges related to the implementation of the device. This project included a presentation and a written component. The grading rubric for both is posted as well as some sample topics that students either completed or could have completed.

[00:02:03.25] Neural engineering is an inherently interdisciplinary field, and I've invited several guest instructors to come speak to you about their areas of expertise. I'm from the graduate program in neuroscience at the University of Washington. And we also have guest instructors from electrical engineering, bioengineering and philosophy. All of these guest instructors are members of labs that are part of the Center for Sensorimotor Neural Engineering.

[00:02:29.53] In this course, we're going to learn about some of the goals of neural engineering and who is involved in the research of new devices, in the medical applications and then the users. We'll learn about many features of the nervous system and body that make neural engineering unique, both in the field of bioengineering and in the field of neuroscience. The brain is the most complicated system known to science, with 86 billion neurons, making an average of 1,000 connections each. This leads to some unique challenges for neural engineering in the complexity of the inputs and outputs that it needs to deal with.

[00:03:05.99] And finally, I'd like you to be able to describe what neural engineering is, what a neural engineering system might include and who would use it. Why is neural engineering

necessary? Why can we not accomplish these things using other methods? Some of the core questions that we'll consider in this course include, what is neural engineering, why do we want to do it, who benefits, who are the users potentially and currently, what do we need to know about the brain and the body in order to do neural engineering correctly, to develop systems that are usable, user friendly and sustainable for long term use and what neural engineering can do that can't be done with other forms of treatment.

[00:03:50.32] Why is neural engineering necessary? Why can't we just do things with other modes of treatment that we already have? This course is divided into several units. First is a unit on neuroscience. Then we will move on to an introduction to principles of engineering. Then we'll focus on motor systems and sensory systems, which are the primary targets of neural engineering today. And we'll conclude by bringing it all together.