

Bioengineering Curriculum Map

	TOPIC	Duration
MAKE	Unit 1 – Build a 3D printed prosthetic hand. Topic: The use of 3D printing for design of prosthetics. Project: Build a prosthetic hand chosen from seven available designs: Raptor Reloaded, Phoenix Hand, Cyborg Beast, Osprey Hand, Talon Hand, Odysseus Hand or Flexy Hand. Source: enablingthefuture.org, a global network of volunteers that makes upper limb prosthetics available as free open source 3D printable devices.	3 wks
	Unit 2 – Redesign of a prosthetic hand. Topic: The engineering cycle. Group project: Optimize and redesign a prosthetic hand that operates with less force to overcome one of the major drawbacks of the prosthetic hands from unit 1.	2 wks
MODEL	Unit 3 – Modeling of biological systems with Differential Equations. Topic: differentiating, integrating, differential equations. Learn how to solve Differential Equations by modeling and simulating them in SciLab, using no more than Algebra 2 level math. Projects: the spread of infectious diseases, predator-prey populations, and sugar insulin levels of blood as a function of time.	2 wks
	Unit 4 – Virtual Reality in Biology and Medicine. Topic: Virtual reality, augmented reality, mixed reality. Learn about the mathematical background of moving objects in 3D space with vectors, translation matrices, and rotation matrices. Experience how virtual reality is used for education in the field of healthcare and medicine. Project: Code a simple virtual reality game in Unity.	4 wks
MEASURE	Unit 5 – Introduction to Signals and Systems. Topics: Analog signals, digital signals, sampling and digitization, aliasing, Nyquist frequency, filtering, time and frequency domain of signals, Fourier transform.	2 wks
	Unit 6 – Speech synthesis Topics: Vocal tract, electronic model of vocal tract, formant frequencies of vowels. Learn how humans produce speech and vowels in particular. Projects: Analysis of 3D printed “vowel filters” using the program Praat. Construction of a model of the vocal tract to generate a particular vowel.	2 wks
FINAL	Open book final	1 wk