

# MS in Computer Science with Emphasis in Neural Engineering

The field of biology has had a significant impact on the engineering curriculum over the past two decades. These developments were spurred by engineering students' growing interest in tackling the theoretical and technical challenges of the biological and medical sciences. This increasingly data- and problem-rich field is attractive for its promise to shed light on biological function and to improve human health. New BS majors in neuroscience, a pipeline of students with background in basic neuroscience is developing all across the nations, and our program directly addresses the need for a Master's level specialization with focus on computational and engineering aspects for students with a BS degree that includes neuroscience courses. Core areas in the MS will include modeling/systems/control concepts related to the brain, signal processing, and machine learning, to effectively reverse engineer the brain, and effectively pursue development of neural prosthetics and implants. The program will thus provide the growing pipeline of BS students with exposure to neural engineering and background to reverse engineer brain circuits, a National Academy of Engineering grand challenge for the 21st century. Mastery over these concepts will enable the students to pursue growing research in the area in academics, industry, and clinical settings.

## Degree Requirements

The degree can be completed in person, online or hybrid. Students will need to complete all departmental guidelines and requirements.

**Take at most 18 credits from the following 7000-level courses.**

**Maximum of two permitted from STAT courses; equivalent courses are acceptable for all courses.**

Required Courses		
ECE 7590	Computational Neuroscience	3
or CMP_SC 7590	Computational Neuroscience	
ECE 7540	Neural Models and Machine Learning	3
or CMP_SC 7540	Neural Models and Machine Learning	
ECE 7830	Introduction to Digital Signal Processing	3-4
or CMP_SC 7820	Introduction to Digital Signal Processing	
Electives		
BIOL_EN 7075	Brain Signals and Brain Machine Interfaces	3
BIOL_EN 7070	Bioelectricity	3
CMP_SC 7001	Topics in Computer Science (Introduction to Computational Neural Engineering)	3
or ECE 7001	Advanced Topics in Electrical and Computer Engineering	
CMP_SC 7750	Artificial Intelligence I	3
ECE 7270	Computer Architecture	4
CMP_SC 7530	Cloud Computing	3
CMP_SC 7380	Database Management Systems I	3
CMP_SC 7410	Theory of Computation I	3
CMP_SC 7315	Feedback Control Systems	3
or BIOL_EN 7310	Feedback Control Systems	
or ECE 7310	Feedback Control Systems	

or MAE 7750	Feedback Control Systems	
MAE 7720	Modern Control	3
BIO_SC 7560	Sensory Physiology and Behavior	3
STAT 7510	Applied Statistical Models I	3
STAT 7520	Applied Statistical Models II	3
STAT 7020	Statistical Methods in the Health Sciences	3

**At least minimum required credits from the following 8000-level courses.**

**Choose at least 2 courses from the following:**

ECE 8570	Neural Dynamics and Communication	3
or CMP_SC 8570	Neural Dynamics and Communication	
ECE 8580	Machine Learning in Neuroscience	3
or CMP_SC 8580	Machine Learning in Neuroscience	
ECE 8001	Advanced Topics in Electrical and Computer Engineering (Computational Neural Engineering)	3
or CMP_SC 8001	Advanced Topics in Computer Science	
ECE 8810	Advanced Digital Signal Processing	3
or CMP_SC 8810	Advanced Digital Signal Processing	
ECE 8860	Probability and Stochastic Processes for Engineers	3
or CMP_SC 8062	Probability and Stochastic Processes for Engineers	

Electives		
ECE 8270	Parallel Computer Architecture	3
CMP_SC 8530	Cloud Computing II	3
CMP_SC 8540	Principles of Big Data and Model Management	3
CMP_SC 8750	Artificial Intelligence II	3
CMP_SC 8725	Supervised Learning	3
CMP_SC 8735	Unsupervised Learning	3
ECE 8800	Sensor Array and Statistical Signal Processing	3
ECE 8320	Nonlinear Systems	3
ECE 8010	Supervised Study in Electrical Engineering	1-3
BIO_SC 8440	Integrative Neuroscience I	3
BIO_SC 8442	Integrative Neuroscience II	3
PSYCH 8110	Cognitive Psychology	3
PSYCH 8210	Functional Neuroscience	3