

Undergraduate Certificate Requirements

Minimum 20 credits

* Students choosing to take project-intensive courses to double count as CORE and PROJECT *may* need to take additional approved electives or the Robotics Seminar to reach the 20 credit hour minimum.

CORE COURSES			
Required:		Choose TWO additional core classes from different categories. Foundational Courses may not be double counted as Core Courses.	
MECHANICS	CONTROL	COGNITION	PERCEPTION
ROBOT 5000/ CS 5310/ ECE 5650/ ME EN 5220 (3 cr) Robotics I: Mechanics	ROBOT 5100 / ME EN 5230 (3 cr) Robotics II: Control	* ROBOT 6200/ CS 6370 / ME EN 6225 (3 cr) Motion Planning or CS 4300 (3 cr) AI	CS 4640 / BME 4640 (3 cr) Image Processing or * CS 5320 (3 cr) Computer Vision
ELECTIVE COURSES			
Select 1 course from any different category:			
MECHANICS	CONTROL	DESIGN	
ROBOT 7000 / ME EN 7230/ CS 7310 (3 cr) Manipulation, Mobility ROBOT 7010 / ME EN 7220/ CS 7320 (3 cr) System Identification	ME EN 5200/ ECE 5615 (3 cr) Classical Control Systems ECE 5670 (3 cr) Control of Electric Motors ME EN 5210/ECE 5652/CH EN 5203 (3 cr) State Space Control ME EN 7200 (3 cr) Nonlinear Control ME EN 7210 (3 cr) Optimal Control ECE 6570 (3 cr) Adaptive Control	*ROBOT 6500/ME EN 5240 (4 cr) Adv. Mechatronics * ROBOT 5960 (3 cr) Wearable Robotics ECE 5780/ CS 5780 (3 cr) Embedded System Design ECE 5960 (3 cr) Robotic Millisystems CS 6956 (3 cr) Medical Robotics	
COGNITION		PERCEPTION	
CS 5350 (3 cr) Machine Learning CS 5958 (3 cr) Robot Learning			
HUMAN-ROBOT INTERACTION	CS 5360 (3 cr) Virtual Reality ROBOT 7400 / ME EN 7240 (3 cr) Haptics *ROBOT 6400/BME 6440/ECE 6654 (4 cr) Neural Engineering		

FOUNDATIONAL COURSES
Complete ONE SET of two courses (students must meet course prerequisites in order to enroll)
Set 1: MECHANICAL ENGINEERING
ME EN 3220 (3 cr) Dynamic Systems & Control ME EN 3230 (4 cr) Mechatronics
Set 2: ELECTRICAL & COMPUTER ENGINEERING
ECE 3610 (3 cr) Fundamentals of Robotics & Cyberphysical Systems ECE 5615 (3 cr) Classical Control Systems
or Set 3: COMPUTER SCIENCE
CS 4300 (3 cr) Artificial Intelligence CS 4640 (3 cr) Image Processing Basics
SEMINAR 1 credit
ROBOT 5800 Robotics Seminar
PROJECT 1 credit minimum
ROBOT 5920 (Independent) Graduate Project with faculty + presentation <i>or</i> * Approved Intensive Project Course