Robotics Undergraduate Certificate Requirements

Minimum total of 20 credits

2 Foundational Courses, 3 Core Courses, 1 Elective, 1 Robotics Seminar, 1 Credit of Undergraduate Project

	Course Number	Course Title	Cross-listings	Offered
	FOUNDATIONAL COURSE REQUIREMENT (Complete one set of two courses):			
	ME EN 3220	Dynamic Systems and Control		
	ME EN 3230	Mechatronics		
	ECE 3610	Fundamentals of Robotics & Cyberphysical Systems		
	ECE 5615	Classical Control Systems		
	CS 4300	Artificial Intelligence		
	CS 4640	Image Processing Basics		
	CORE COURSE REQUIREMENT:	**Course Title**	**Cross-listings**	**Offered**
	Robot Mechanics Core Area (Required):			
	ROBOT 5000	Robotics I: Mechanics (formerly Intro to Robotics)	CS 5310, ECE 5650, ME EN 5220	Fall
	CHOOSE 2 CORE COURSES FROM 2 DIFFERENT AR	**Course Title**	**Cross-listings**	**Offered**
	Robot Control Core Area:			
	ROBOT 5100	Robotics II: Control (formerly Intro to Robot Control)	ME EN 5230	Spring
	Cognition Core Area:			
	ROBOT 6200	Motion Planning	CS 6370, ME EN 6225	Spring
	CS 4300 (if not used as Foundational Course)	Artificial Intelligence		Fall
	Perception Core Area:			
	CS 4640	Image Processing	BME 4640	Fall
	CS 5320	Computer Vision		Fall
	ELECTIVE COURSE REQUIREMENT: Select 1 course from any category; core courses listed above that are not used to fulfill a core area requirement may also be considered.	**Course Title**	**Cross-listings**	**Offered**
	Robot Mechanics Category Electives:			
	ROBOT 7000	Manipulation and Mobility	ME EN 7230, CS 7310	Spring, odd years
	ROBOT 7010	System ID for Robotics	CS 7320, ME EN 7220	Fall, odd years
	Robot Control Category Electives:			
	ME EN 5200 or ECE 5615 (if not used as Foundatio	Classical Control Systems		Fall
	ECE 6670	Control of Electric Motors		Spring
	ME EN 5210 or ECE 5652 or CH EN 5203	Linear Systems & State Space Control		Spring
	ME EN 7200	Nonlinear Control		Fall, even years

	ME EN 7210	Optimal Control		Spring, even years
	ECE 6570	Adaptive Control		Varies
	Cognition Category:			
	CS 5350	Machine Learning		Fall, Spring
	CS 5958	Robot Learning (currently special topics)		Varies
	Perception Category:			
	CS 7640	Advanced Image Processing		Varies
	CS 5353	Deep Learning for Image Analysis		Fall
	ECE 5530	Digital Signal Processing		Fall
	Human-Robot Interaction Category:			
	CS 5360	Virtual Reality		Fall
	ROBOT 7400	Haptics for VR, Teleoperation, Physical Human-Robot Interaction	ME EN 7240	Fall, odd years
	ROBOT 6400	Neuro-Robotics (will be cross listed with BME 6440)	BME 6440, ECE 6654	Fall
	Robot Design Category:			
	ROBOT 6500	Advanced Mechatronics	ME EN 6240	Spring, even years
	ROBOT 6510	Wearable Robotics		Fall, even years
	ECE 5780 or CS 5780	Embedded System Design		Spring
	ECE 6960	Robotic Millisystems		Fall, odd years
	CS 6956	Medical Robotics (currently special topics)		Spring, even years
	SEMINAR REQUIREMENT (1 credit)	**Course Title**	**Cross-listings**	**Offered**
	ROBOT 5800	Robotics Seminar (enroll in one semester for 1 credit)		Fall, Spring
	PROJECT REQUIREMENT (1 credit)	**Course Title**	**Cross-listings**	**Offered**
	ROBOT 5920	Graduate Project		