

## Robotics Certificate Curriculum

Each student is required to complete the 7 courses in one of the tracks below (i.e., one row of the table), plus a multidisciplinary robotics senior design project, by taking ROBO410, ROBO420, and ROBO430<sup>13</sup>.

#	Track	1	2	3	4	5	6	7	Electives <sup>11</sup> [tracks which may take each are listed in brackets]	
1	CSSE with Controls <sup>1,2,3</sup>	Intro to Robotics Programming (CSSE120R) <sup>9</sup>	Mechatronics (ME430)	(DC Circ. (ECE203) + AC Circ. (ECE204)) OR (Elec. Sys. (ES203) + Elec. Eng. (ECE207))		Linear Control Systems (ECE320) <sup>10</sup>	Mobile Robotics (ECE497)	Elec		
2	CSSE with Hardware <sup>1,2</sup>			(DC Circ. (ECE203) + AC Circ. (ECE204)) OR (Elec. Sys. (ES203) + Elec. Eng. (ECE207))		Robotics Engineering (ME435)	Artificial Intelligence (CSSE413)	Elec	Artificial Intelligence (CSSE 413) [1,3-5,9] Computer Vision (CSSE 461)[1-9] Image Recognition (CSSE 463)[1-9] Swarm Intelligence (CSSE 490)[1-3,5,9] Teamwork and Robotics (CSSE 490)[1-9] Linear Controls (ECE 320)[2,3]	
3	CSSE with Mechanics <sup>1,2,4</sup>			Conservation & Acct. Princ. (ES201)	Mechanical Systems (ES204)	Kinematics (ME403)	Robotics Engineering (ME435)	Elec	Signals and Systems (ECE 300)[1,2,3,8-9] Wireless Systems (ECE 414)[1-9] Mobile Robotics (ECE 497)[2,3]	
4	CPE <sup>5</sup>			Linear Control Systems (ECE320)	Data Structures and Analysis (CSSE230)	Statics & Mech. of Materials I (EM121)	Mobile Robotics (ECE497)	Elec	Discrete-time Control Systems (ECE 520)[1,4-9] Modern Control Systems (ECE 521)[1,4-9] Kinematics of Machinery (ME 403)[1,2,4-6] Control Systems (ME 406)[2,3]	
5	EE with Programming <sup>6</sup>			Object-oriented Software Dev (CSSE220)	Data Structures and Analysis (CSSE230)	Robotics Engineering (ME435)	Mobile Robotics (ECE497)	Elec	Robotics Engineering (ME 435)[1,4,6,7] Advanced Control Sys (ME 506)[1,3-9] Advanced Kinematics (ME 518)[3,7-9] Microsensors (PH 408)[1-5,7-9]	
6	ECE with Sensors <sup>6</sup>			Optical Systems (OE295)	Microsensors (PH408)	Image Proc. (ECE480/PH437) or Wireless Sys. (ECE414)	Mobile Robotics (ECE497)	Elec	Image Proc (ECE 480/PH 437)[1-9] if not used as req course for track 6 Adv Image Proc (ECE 580/PH 537)[1-9]	
7	ECE with Mechanics <sup>6</sup>			Conservation & Acct. Princ. (ES201)	Mechanical Systems (ES204)	Kinematics (ME403)	Mobile Robotics (ECE497)	Elec	Senior Capstone Design Credits above Major Requirements (ROBO410,420,430)[8-9]	
8	ME with Electronics <sup>7,8,12</sup>			Kinematics (ME403)	Introduction to Logic Design (ECE130)	Electronic Device Modeling (ECE250)	Robotics Engineering (ME435)	Digital Systems (ECE333)	Cap Desn Credits (ROBO4xx)	
9	ME with Programming <sup>7</sup>			Kinematics (ME403)	Object-oriented Software Dev (CSSE220)	Data Structures and Analysis (CSSE230)	Robotics Engineering (ME435)	Mobile Robotics (ECE497)	Cap Desn Credits (ROBO4xx)	

1. CSSE220,230 already required for CS and SE majors.
2. SE majors should pursue the corresponding domain track.
3. CSSE majors pursuing this track need only 1 additional class to obtain an ECE minor. To do that, they will need ECE203+ECE204.
4. Students in this track will need to obtain electronics experience to satisfy the ME430 prerequisites.
5. CSSE220, ECE130, ECE203, ECE204, ECE333 already required for CPE majors
6. ECE203, ECE204, ECE230, ECE320 already required for EE majors
7. ME430 already required for ME majors. **ME majors must also choose ME406 Controls, not Vibrations, as a restricted elective.**
8. Students in this track will need to take ECE203 and ECE204 instead of ES203 and ECE207, as a prerequisite for ECE250. This is a standard substitution.
9. CSSE221 (Honors) or CSSE120 can substitute here.
10. A student may substitute ME406 Controls. This currently requires a longer list of prerequisites.
11. This list is intended to exclude all robotics electives already required by the student's chosen major or track.
12. Students in this track need only 1 additional ECE class to obtain an ECE minor. To do that, they will need to take ECE203 + ECE204 instead of ES203 + ECE207.
13. ROBO410, 420 and 430 replaces ECE460, 461, and 462 for ECE majors, ME471, 472, and a 4 credit hour technical elective for ME majors, and CSSE497, 498 and 499 for CSSE majors. CSSE majors must also complete an additional 3-credit technical elective since the ROBO capstone sequence has 3 fewer hours than the CSSE one.

### Color Key

Computer Science and Software Engineering
Electrical and Computer Engineering
Mechanical Engineering
Physics and Optical Engineering

## Prerequisite analysis (to ensure every major can complete a track without overloading)

Major		1	2	3	4	5	6	7	Notes	Total electives
1 CSSE with Controls	CSSE120R replaces CSSE120	ME430 (FE)	ECE203 (TE)	ECE204 (TE)	ECE320 (FE)	ECE497 (FE)	Elec (AE)		Need PH113 (SciE), MA222 (TE) is also desirable. SE choose Robotics application domain track.	CS: 1 AE, 3 TE, 3 FE (2 FE remaining) SE: 1 AE, 1 TE, 5 FE (2 FE remaining)
2 CSSE with Hardware	CSSE120R replaces CSSE120	ME430 (FE)	ES203 (TE)	ECE207 (TE)	ME435 (FE)	CSSE413 (AE)	Elec (AE)		Need PH113 (SciE), MA222 (TE) is also desirable. SE choose Robotics application domain track.	CS: 2 AE, 3 TE, 2 FE (3 FE remaining) SE: 1 AE, 1 TE, 5 FE (2 FE remaining)
3 CSSE with Mechanics	CSSE120R replaces CSSE120	ME430 (FE)	ES201 (FE)	ES204 (FE)	ME403 (FE)	ME435 (FE)	Elec (AE)		Need PH113 (SciE), MA222 (TE) is also desirable. SE choose Mech. Robotics application domain track.	CS: 1 AE, 1 TE, 5 FE (2 TE remaining) SE: 1 AE, 1 TE, 5 FE (2 FE remaining)
4 CPE	CSSE120R replaces CSSE120	ME430 (TE)	ECE320 (FE)	CSSE230 (TE)	EM121 (FE)	ECE497 (AE)	Elec (AE)		If elective is a 400+-level ECE course (an AE), then no overload is required.	2 AE, 2 TE, 2 FE (none remaining)
5 EE with Programming	CSSE120R replaces CSSE120	ME430 (FE)	CSSE220 (TE)	CSSE230 (TE)	ME435 (FE)	ECE497 (AE)	Elec (AE)		If elective is a 400+-level ECE course (an AE), then no overload is required.	2 AE, 2 TE, 2 FE (none remaining)
6 ECE with Sensors	CSSE120R replaces CSSE120	ME430 (TE)	OE295 (TE)	PH408 (FE)	ECE480/414 (AE)	ECE497 (AE)	Elec (FE)		If elective were 400+-level ECE course (an AE), then they would still have a FE instead of an AE.	2 AE, 2 TE, 2 FE (none remaining)
7 ECE with Mechanics	CSSE120R replaces CSSE120	ME430 (TE)	ES201 (FE)	ES204 (FE)	ME403 (TE)	ECE497 (AE)	Elec (AE)		If elective is a 400+-level ECE course (an AE), then no overload is required.	2 AE, 2 TE, 2 FE (1 AE remaining)
8 ME with Electronics	CSSE120R replaces ME123	ME403 (TE)	ECE130 (FE)	ECE250 (TE)	ME435 (AE)	ECE333 (TE)	Sr Des. Credits (FE)			3 TE, 1 AE, 2 FE (none remaining)
9 ME with Programming	CSSE120R replaces ME123	ME403 (TE)	CSSE220 (FE)	CSSE230 (TE)	ME435 (AE)	ECE497 (FE)	Sr Des. Credits (TE)			3 TE, 1 AE, 2 FE (none remaining)

**Key**

AE = area elective

TE = technical elective

SciE = science elective

FE = free elective