ROBOTICS

Requirements

Robotics is a fast-growing field that is inherently multidisciplinary, incorporating mechanical systems, electrical systems, and software. It includes mobile robotics, mechatronics, and assistive technologies. Rose-Hulman Institute of Technology offers a multidisciplinary minor in robotics to recognize students who have gained experience in these areas while at Rose-Hulman.

To earn the Multidisciplinary Minor in Robotics, a student needs to complete the three courses listed below plus additional courses listed below per the student's major.

Courses that all majors must complete [12 credit hours]

Code	Title	Hours
CSSE 120	Introduction to Software Development [1,2]	4
ME/CSSE 435	Robotics Engineering	4
ECE 425	Introduction to Mobile Robotics	4

1 Note for ME and BE students: CSSE120 can be used as a course substitution for the required introduction to programming course (ME 123 Computer Programming or BE 100 Problem Solving in the Biological Sciences & Engineering). However, ME and BE students may take both the required class AND CSSE 120 Introduction to Software Development. CSSE 120 Introduction to Software Development will then count as a free elective.

2 Note for ENGD students: CSSE 120 Introduction to Software Development is taught within ENGD 110 Static Analysis, Testing, and Sociotechnical Thinking/ENGD 120 Integrating Electrical, Software, and Societal Systems.

In addition to the courses listed above students completing the robotics minor need to complete the courses below that apply to their major. (Students with a double major or double degree may choose which major to use. If a student decides to switch majors, that student must complete a track below appropriate for their final degree. These degree requirements are evaluated only at the time of your graduation.)

CS and SE Majors - Additional Required Courses

Code	Title	Hours
ME 230	Mechatronic Systems	4
Select eight credits of Robo Electives (see list below)		8

CPE Majors - Additional Required Courses

Code	Title	Hours
CSSE 463	Image Recognition	4
ECE 320	Linear Control Systems [1]	4
Select eight credits of Robo Electives (see list below)		8

1 Note, the list of additional required CPE courses appears to be 1 course longer than other tracks, but CPE students are required to take either ECE 320 Linear Control Systems or ECE 380 Discrete-Time Signals and Systems already, so the requirement to take ECE 320 Linear Control Systems should not cause the CPE track to be any longer.

EE Majors - Additional Required Courses

Code	Title	Hours
CSSE 220	Object-Oriented Software Development	4
Select eight credits of Robo Electives (see list below)		8

ME Majors - Additional Required Courses

Code	Title	Hours
CSSE 220	Object-Oriented Software Development	4
ME 306	Control Systems	4
ME 404	Advanced Design of Mechanisms	4
or ME 445	Robot Dynamics and Control	
Select four credits of Robo Electives (see list below)		

1 Note, the list of additional required ME courses appears to be 1 course longer than other tracks, but ME students are required to take either ME 306 Control Systems or EM 306 Vibration Analysis already, so the requirement to take ME 306 Control Systems should not cause the ME track to be any longer.

ENGD Majors - Additional Required Courses

Code	Title	Hours
ES 214	Mechanical Systems	4
ES 305	System Dynamics	4
ME 230	Mechatronic Systems	4
ME 306	Control Systems	4
MDS 410 & MDS 420 & MDS 430	Multidisciplinary Capstone I and Multidisciplinary Capstone II and Multidisciplinary Capstone III [1]	12

1 ENGD majors should select projects that build on robotics learning from earlier courses.

For Majors Not Listed Above - Additional Required Courses

Code	Title	Hours
CSSE 220	Object-Oriented Software Development	4
ME 230	Mechatronic Systems	4
Select one of the following:		4
BE 350	Biocontrol Systems	
ECE 320	Linear Control Systems	
ME 306	Control Systems	
or a Controls course from any major [1]		
Select four credits of Robo Electives (see list below)		

1 For BE majors, a controls course will fill an area requirement. So, much like the ME track, the requirement to have a controls course should not cause this track to be longer for BE majors than tracks for other majors.

Robotics Electives

Students choose Robotics Electives from the list below subject to the restrictions that a student's Robotics Elective courses(s) cannot be any course listed above as an additional required course for the student's

major, and cannot be a course listed as a named requirement for the student's major.

Code	Title	Hours
BE 350	Biocontrol Systems	4
BE 520	Introduction to Brain Machine Interfaces	4
BE 543	Neuroprosthetics	4
CSSE 286	Introduction to Machine Learning	4
CSSE 313	Artificial Intelligence	4
CSSE 480	WebApp Frameworks w/ AppEngine	4
CSSE 461	Computer Vision	4
CSSE 463	Image Recognition	4
CSSE 490	Special Topics in Computer Science	1-4
CSSE 290/490	Special Topics in Computer Science	1-4
ECE 320	Linear Control Systems	4
ECE 300	Continuous-Time Signals & Systems	4
ECE 414	Wireless Systems	4
ECE 420	Discrete-Time Control Systems	4
CE 480	Geometric Design of Highways and Streets	4
ECE 483	DSP System Design	4
ECE 497	Special Topics in Electrical Engineering	1-10
ECE 582/OE 537	Advanced Image Processing	4
MA/CSSE 415	Machine Learning	4
MA/CSSE 416	Deep Learning	4
ME 304	Introduction to the Design of Mechanisms	4
ME 306	Control Systems	4
ME 404	Advanced Design of Mechanisms	4
ME 445	Robot Dynamics and Control	4
ME 497	Special Topics in Mechanical Engineering (Design of Mechanisms I)	1-5
ME 497	Special Topics in Mechanical Engineering (Design of Mechanisms II)	1-5
ME 497	Special Topics in Mechanical Engineering (Industrial Controls)	1-5
ME 497	Special Topics in Mechanical Engineering (Three Dimensional Dynamics)	1-5
ME 506	Advanced Control Systems	4
EM 502	Advanced Dynamics	4
NE 408	Microsensors and Actuators	4
CSSE 490/ ME 497/ECE 497	Special Topics in Computer Science	1-4
Independent study courses in robotics (requires approval BEFORE the course is taken)		4