ROBOTICS ENGINEERING

Description

Building upon the foundation of engineering principles, the Robotics Engineering program seeks to cultivate a diverse community of learners who are passionate about pushing the boundaries of technology. Through an interdisciplinary curriculum, comprehensive projects, and experiential learning opportunities, students will gain hands-on experience in designing, implementing, and optimizing robotic systems. To achieve this interdisciplinary approach, the proposed program will be administered by the School of Computing, Electrical Engineering Department, and the Mechanical Engineering Department, with a core of courses including multiple offerings from each discipline with three possible emphasis tracks, allowing students to specialize in one of these three foundational disciplines. The Robotics Engineering Program at the University of Nebraska-Lincoln is dedicated to advancing knowledge and innovation in the field of robotics and automation. Our mission is to educate and empower students to become proficient and ethical robotics and automation professionals who can contribute to the societal, industrial, and technological challenges of today and tomorrow. Through rigorous academic programs, cutting-edge research, and impactful outreach, we strive to foster a culture of learning, collaboration, and esponsible use of robotic and automation technologies.

College Requirements

College Admission

College Entrance Requirements

Students must meet both the University and College of Engineering entrance requirements. The following includes both the University and College of Engineering entrance requirements.

Students must have high school credit for (one unit is equal to one high school year):

1. Mathematics – 4 units: 2 of algebra, 1 of geometry, and 1 of precalculus and trigonometry
2. English – 4 units
3. Natural sciences – 3 units that must include 1 unit of physics and 1 unit of chemistry (chemistry requirement waived for students in construction management or computer science)
4. Foreign language – 2 units of a single foreign language
5. Social studies – 3 units
6. Students having a composite ACT score of 28 or greater (or equivalent SAT score) will be admitted to the College of Engineering even if they lack any one of the following: trigonometry, chemistry, or physics. Students without test scores who are missing a full unit of trigonometry/pre-calculus/calculus or chemistry or physics will be evaluated through College Review.
7. Students having an ACT score of 19 or less in English (or equivalent SAT score) or a grade lower than B in high school English, must take ENGL 150 Writing and Inquiry or ENGL 151 Writing for Change.

A total of 16 units is required for admission.

Engineering requires that student performance meet one of the following standards: composite ACT of 24, SAT of 1180, ACT Math subscore of 24, SAT Math subscore of 580, or a 3.5 cumulative GPA.

Any domestic first-year student who does not gain admission to Engineering but does gain admission to the University of Nebraska-Lincoln (UNL) will be reviewed through College Review. College Review is conducted through the College Review Committee which considers factors beyond standardized testing. Any first-year student who is not admitted through college review is placed in Pre-Engineering (PENG) with the Exploratory and Pre-Professional Advising Center (Explore Center). Students in the Explore Center can transfer to the College of Engineering once college admission requirements are met.

Students for whom English is not their language of nurture must meet the minimum English proficiency requirements of the University.

Students who lack entrance units may complete precollege training by Independent Study through the University of Nebraska–Lincoln Office of On-line and Distance Education, in summer courses, or as a part of their first or second semester course loads while in the Explore Center or other colleges at UNL.

Students should consult their advisor, their department chair, or Engineering Student Services (ESS) if they have questions on current policies.

Other Admission Requirements

Students who transfer to the University of Nebraska–Lincoln from other accredited colleges or universities and wish to be admitted to the College of Engineering (COE) must meet COE first-year student entrance requirements, have a minimum cumulative GPA of 2.5, and be calculus-ready. Students not meeting either of these requirements must enroll in the Explore Center or another University college until they meet COE admission requirements. Students transferring from UNO, UNL, or UNK to the College of Engineering must be in good academic standing with their institution.

The COE accepts courses for transfer for which a C or better grade was received. Although the University of Nebraska–Lincoln accepts D grades from the University of Nebraska Kearney and the University of Nebraska Omaha, not all majors in the COE accept such low grades. Students must conform to the requirements of their intended major and, in any case, are strongly encouraged to repeat courses with a grade of C- or less.

Students who were previously admitted to COE and are returning to the College of Engineering must demonstrate a cumulative GPA of 2.5 to be readmitted to COE.

College Degree Requirements

Grade Rules

Grade Appeals

In the event of a dispute involving any college policies or grades, the student should appeal to their instructor, and appropriate department chair or school director (in that order). If a satisfactory solution is not achieved, the student may appeal their case through the College Academic Appeals Subcommittee.

Catalog Rule

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted at the University of Nebraska–Lincoln. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at Nebraska in the College of Engineering. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for

degree requirements may not be more than 10 years old at the time of graduation.

Students who have transferred from a community college may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska-Lincoln.#This decision should be made in consultation with the student's College of Engineering academic advising team (e.g., ESS professional advisor and the chief faculty advisor for the student's declared degree program).#The chief faculty advisor has the final authority for this decision. Eligibility is based on a) enrollment in a community college during the catalog year the student wishes to utilize, b) maintaining continuous enrollment of at least 12 credit hours per semester at the previous institution for at least 2 semesters, and c) continuous enrollment at the University of Nebraska-Lincoln within 1 calendar year from the student's last term at the previous institution. #Students must complete all degree requirements from a single catalog year and within the timeframe allowable for that catalog year.

Learning Outcomes

Graduates of the robotics engineering program will have:

1. An ability to identify, formulate, and solve complex engineering problems in the field of robotics and automation by applying principles of engineering, science, and mathematics.
2. An ability to design and implement robotic and automation solutions that meet specified needs, considering factors such as safety, ethics, and the impact on global, cultural, social, environmental, and economic contexts.
3. Effective communication skills with a range of audiences, including the ability to present and document engineering work clearly and professionally.
4. Recognition of ethical and professional responsibilities in engineering situations, making informed judgments that consider the broader impact of robotic solutions on a global scale.
5. The ability to function effectively as a member of a diverse and inclusive team, demonstrating leadership skills, goal-setting, and collaborative problem-solving.
6. Competence in developing and conducting appropriate experiments, analyzing and interpreting data, and using sound judgment to draw conclusions in the context of robotics and automation engineering
7. The ability to acquire and apply new knowledge as needed, utilizing appropriate learning strategies to adapt to the rapidly evolving field of robotics and automation.

The above student outcomes have been approved by the ABET Engineering Area Delegation for use beginning with the 2019-20 academic year, and have been adopted by the College of Engineering faculty.

Major Requirements

The robotics engineering degree requires 128 hours of coursework.

Robotics Core		
ROBO 100	Introduction to Robotics	3
ROBO 150	Robotics Tools	3
ENGR 291	Sophomore Engineering Special Topics	3
ECEN 345	Mobile Robotics I	4
ENGR 395	Engineering Internship	1
ROBO 302	Robotic Design and Control	3
ROBO 303	Robotic Software and Algorithms	3
ROBO 350	Robotic Systems Integration	3
ENGR 447	Multi-disciplinary Engineering Capstone	3
ENGR 447	Multi-disciplinary Engineering Capstone	3
Credit Hours Subtotal:		29
Engineering Seminars		
ENGR 10	Freshman Engineering Seminar [1]	0
or ENGR 30	Transfer Student Engineering Seminar	
ENGR 20	Sophomore Engineering Seminar [2]	0
Credit Hours Subtotal:		0
Mathematics		
MATH 106	Calculus I	5
MATH 107	Calculus II	4
MATH 221	Differential Equations	3
ECEN 305 / MECH 321	Probability Theory and Statistics for Electrical and Computer Engineers	3
Credit Hours Subtotal:		15
Science		
PHYS 211	General Physics I	4
PHYS 221	General Physics Laboratory I	1
PHYS 212	General Physics II	4
PHYS 222	General Physics Laboratory II	1
ECEN 215	Electronics and Circuits I	3
ECEN 235	Introductory Electrical Laboratory I	1
Credit Hours Subtotal:		14
Technical Writing (ACE 1)		
ENGR 220	Technical Writing in Engineering	3
or ENGL 151	Writing for Change	
or ENGL 150	Writing and Inquiry	
Credit Hours Subtotal:		3
Communication (ACE 2)		
ENGR 100	Interpersonal Skills for Engineering Leaders	3
or COMM 286	Business and Professional Communication	
Credit Hours Subtotal:		3
ACE Requirements		
Select one course each from ACE 5, 6, 7, 9		12
Credit Hours Subtotal:		12
Core Computer Science Requirements		
CSCE 155E	Computer Science I: Systems Engineering Focus	3
CSCE 156	Computer Science II	4
CSCE 311	Data Structures and Algorithms for Informatics	3
or CSCE 310	Data Structures and Algorithms	
Credit Hours Subtotal:		10
Core Electrical Engineering Requirements		
ECEN 216	Electronics and Circuits II	3
ECEN 236	Introductory Electrical Laboratory II	1
ECEN 220 / CSCE 336	Introduction to Embedded Systems	4
ECEN 304	Signals and Systems I	3
Credit Hours Subtotal:		11

Core Mechanical Engineering Requirements		
MECH 223	Engineering Statics	3
MECH 373	Engineering Dynamics	3
MECH 350	Introduction to Dynamics and Control of Engineering Systems	3
Credit Hours Subtotal:		9
Technical electives		
Take 23 elective credits from one focus area		23
Credit Hours Subtotal:		23

[1] ENGR 193 *may apply for* ENGR 10 *(students must be in the Kiewit Scholars Program to take the course).*

[2] ENGR 493 *may apply for* ENGR 20 *(students must be in the Kiewit Scholars Program to take the course).*

Technical Electives Focus Areas

Robot Design/Build

MECH 230	Introduction to Mechanical Engineering Design	3
MECH 343	Elements of Machine Design	3
MECH 437	Biomedical Device Design	3
MECH 442	Intermediate Kinematics	3
MECH 449	Advanced Dynamics	3
MECH 453	Robotics: Kinematics and Design	3
MECH 450	Mechanical Engineering Control Systems Design	3
MECH 457	Mechatronic Systems Design	3
MECH 492	Special Topics	1-6
Advisor-approved 400 level MECH course		

Robot Software/Algorithms

CSCE 230	Computer Organization	4
CSCE 351	System Resource Management	3
CSCE 361	Software Engineering	3
CSCE 436	Advanced Embedded Systems	3
CSCE 454	Human-Robot Interaction	3
CSCE 460	Software Engineering for Robotics	3
CSCE 473	Computer Vision	3
CSCE 476	Introduction to Artificial Intelligence	3
CSCE 492	Special Topics in Computer Science	1-3
Advisor-approved 400 level CSCE course		

Robot Sensors/Signals

ECEN 370	Digital Logic Design	3
ECEN 327	Discrete Systems Laboratory	1
ECEN 433	Microprocessor System Design	4
ECEN 463	Digital Signal Processing	3
ECEN 435	Embedded Microcontroller Design	4
ECEN 428	Power Electronics	4
ECEN 444	Linear Control Systems	3
ECEN 464	Digital Communication Systems	3
ECEN 492	Special Topics in Electrical and Computer Engineering IV	1-3
Advisor-approved 400 level ECEN course		

Requirements for Minor Offered by Department

The robotics engineering minor consists of three core courses and three elective courses. When selecting electives, the student must take two courses outside of their major area of study. For example, a student in mechanical engineering might take an elective from the School of Computing and one from the Department of Electrical Engineering.

Core Requirements		
Select one course from each of the three following topic areas:		
Topic Area: Core Programming [1]		*3-4*
CSCE 155A	Computer Science I	
CSCE 155E	Computer Science I: Systems Engineering Focus	
CSCE 155H	Honors: Computer Science I	
CSCE 155N	Computer Science I: Engineering and Science Focus	
CSCE 155T	Computer Science I: Informatics Focus	
CSCE 156	Computer Science II	
CIST 1400	UNO course	
Topic Area: Controls		*3-4*
ECEN 220	Introduction to Embedded Systems	
ECEN 444	Linear Control Systems	
ECEN 491	Special Topics in Electrical and Computer Engineering IV	
MECH 350	Introduction to Dynamics and Control of Engineering Systems	
Topic Area: Embedded Systems		*3-4*
ECEN 106	Microprocessor Applications	
CSCE 336	Embedded Systems	
MECH 457	Mechatronic Systems Design	
Credit Hours Subtotal:		9-12
Elective Requirements		
Three courses from the following list of electives are required; two must be outside your department.		7-10
CSCE 436	Advanced Embedded Systems	
CSCE 439	Robotics: Algorithms and Applications	
CSCE 473	Computer Vision	
CSCE 476	Introduction to Artificial Intelligence [2]	
CSCE 4XX	special topics courses on Robotics	
ECEN 345	Mobile Robotics I	
ECEN 428	Power Electronics	
ECEN 433	Microprocessor System Design	
ECEN 435	Embedded Microcontroller Design	
ECEN 444	Linear Control Systems	
ECEN 460	Labview Programming	
ECEN 462	Communication Systems	
ECEN 498	Research in Electrical Engineering IV	
MECH 342	Kinematics and Dynamics of Machinery	
MECH 450	Mechanical Engineering Control Systems Design	
MECH 442	Intermediate Kinematics	
MECH 444	Intermediate Dynamics of Machinery	

MECH 449	Advanced Dynamics	
MECH 453	Robotics: Kinematics and Design	
MECH 458	Digital Control of Mechanical Systems	
MECH 488	Kinematics and Machine Design Laboratory	
Credit Hours Subtotal:		7-10
Total Credit Hours		**16-22**

[1] *AP or transfer credit equating to CSCE 155 may also apply.*

[2] *On the Omaha Campus—similar courses being offered by CIST could be substitutions.*

Grade Rules

Pass/No Pass

No course taken Pass/No Pass will be counted toward the minor.