March 31, 2025

David Jackson, Interim Executive Vice President & Provost
University of Nebraska
3835 Holdrege Street
Lincoln, NE 68583-0745

Dear Dr. Jackson,

I am forwarding to you materials related to a proposal to create a new Bachelor of Science in Robotics Engineering to be administered by the College of Engineering. The proposed degree program is an interdisciplinary collaboration between the School of Computing, Department of Electrical and Computer Engineering, and Mechanical and Materials Engineering. The program is designed to meet the growing demand in this field, specifically in Nebraska, and is supported by external market data and letters of support from industry.

The proposed major utilizes existing resources already in place, given the existing programs in computing, electrical engineering, and mechanical engineering and centralized College of Engineering student support services. The program fulfills a critical and unmet need at the University of Nebraska-Lincoln and is strongly supported by key community college partners.

The degree requirements align with other College of Engineering programs and adhere to the Accreditation Board for Engineering and Technology (ABET) professional accreditation standards. Therefore, I fully support the 128-credit hour program and the exception request of the Board of Regents 120-Credit Hour Policy (RP-5.1.4).

This proposal has the unanimous endorsement of the Academic Planning Committee, the full support of the College of Engineering faculty and curriculum committees, and the support of Dean Lance Pérez. The proposal is also supported by Interim Executive Vice Chancellor Mark Button, and it has my approval. I am requesting you approve it and that it be reported to the Board of Regents at its next regular meeting.

Sincerely,

Rodney D. Bennett
Chancellor

c: Jennifer Clarke, Chair, Academic Planning Committee
Mark Button, Interim Executive Vice Chancellor
Lance Pérez, Dean, College of Engineering
Josh Davis, Associate to the Chancellor
Renee Batman, Assistant Vice Chancellor
Suzi Tamerius, Project Coordinator
Karen Griffin, Coordinator of Faculty Governance
Andrea Kessler, Administrative Assistant

University of Nebraska Lincoln

FACULTY SENATE OFFICE
ACADEMIC PLANNING COMMITTEE

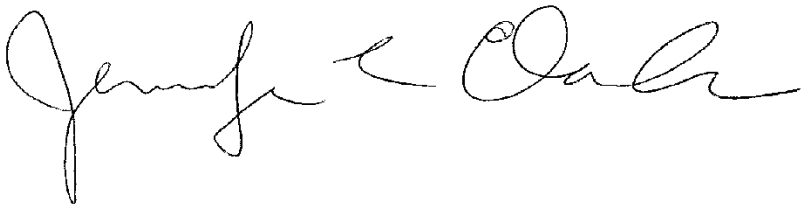
March 27, 2025

Chancellor Rodney Bennett
201 Canfield Administration
City Campus (0419)

Dear Chancellor Bennett:

The Academic Planning Committee (APC) considered a proposal to create a new Bachelor of Science in Robotics Engineering program. The program is administered by the College of Engineering and is an interdisciplinary collaboration between the School of Computing, Department of Electrical and Computer Engineering, and Mechanical and Materials Engineering. The APC voted to recommend approval of the proposal at its March 27, 2025, meeting and I am forwarding this proposal for your consideration.

Sincerely,



Jennifer Clarke, Chair, Academic Planning Committee and Professor, Food Science and Technology

c: Interim Executive Vice Chancellor Mark Button
Dean Lance Perez
Professor Witty Srisa-an
Professor Jerry Hudgins
Professor Jeffrey Shield
Associate to the Chancellor Josh Davis
Assistant Vice Chancellor Renee Batman
Project Coordinator Suzi Tamerius

135 Alexander Building /312 N. 14th Street/ Lincoln, NE 68588-0471/ (402) 472-2573 / EMAIL: kgriffin2@unl.edu

MEMORANDUM

TO: Academic Planning Committee Chair

FROM: Mark Button, Interim Executive Vice Chancellor

DATE: January 24, 2025

SUBJECT: Proposal to Create a Bachelor of Science in Robotics Engineering

Attached please find a proposal to create a new Bachelor of Science in Robotics Engineering to be administered by the College of Engineering. The proposed degree program is an interdisciplinary collaboration between the School of Computing, Department of Electrical and Computer Engineering, and Mechanical and Materials Engineering. The program is designed to meet the growing demand in this field, specifically in Nebraska and is supported by external market data and letters of support from industry.

The program leverages our core strength, existing courses, and provides a specialty that will attract new students. I appreciate the efforts undertaken to design a program that is reflective of our need to steward resources and provide innovative and rigorous programs for students.

The degree requirements are aligned with other College of Engineering programs and is structured to meet Accreditation Board for Engineering and Technology (ABET) professional accreditation standards. Thus, I fully support the 128-credit hour program and the exception request of the Board of Regents 120-Credit Hour Policy (RP-5.1.4).

The college has carefully considered the resources required to support the new major as outlined in the proposal. Much of what is required is already in place, given the existing programs in computing, electrical engineering, and mechanical engineering and centralized College of Engineering student support services. I am confident that Dean Pérez will prioritize college resources to continue to support the faculty needed for the program.

This new undergraduate degree program has the full support of the faculty and curriculum committees and Dean Lance C. Pérez. I fully support this proposal.

University of Nebraska Lincoln
Office of the Executive Vice Chancellor and Chief Academic Officer
208 Canfield Administration Building | P.O. Box 880420 | Lincoln, NE 68588-0420 | 402.472.3751 | FAX 402.472.4929

October 15, 2024

Kathleen Ankerson
Executive Vice Chancellor
208 Canfield Administration Building
Lincoln, NE 68588-0106

Dear Executive Vice Chancellor Ankerson:

I am writing to provide my strongest support for the attached proposal to create a Bachelor of Science in Robotics degree program. The proposed degree fulfills a growing workforce need in the state of Nebraska, the region and the nation. The College of Engineering has a long track record in the field of robotics and it is a strength of our faculty across several academic units. The development of this degree program is funded by the Heartland Robotics Cluster (HRC), a collaboration between the College of Engineering, Metro Community College and Invest Nebraska, and has widespread industry support. The HRC is providing funding for a new instructional robotics laboratory that will be used in the new degree program. This proposal is strongly aligned with the undergraduate enrollment growth goal in the strategic plans of the College of Engineering.

Attached to this letter is the proposal that was reviewed and approved by the college and other supporting documents. If you have any questions regarding the proposal, please do not hesitate to contact me.

Sincerely,

Lance C. Pérez, Ph.D., FASEE
Fred Hunzeker Dean of Engineering
Omar H. Heins Professor of Electrical and Computer Engineering

University of Nebraska Lincoln
College of Engineering
114 Othmer Hall | P.O. Box 880642 | Lincoln, NE 68588-0642 | 402.472.3181 | FAX 402.472.7792
1110 S. 67th St. | The Peter Kiewit Institute | Omaha, NE 68182-0176 | 402.554.6009 | FAX 402.554.2309
engineering.unl.edu

April 17, 2024

Associate Dean Mark Riley

Subject: Support for Robotics Engineering Baccalaureate

To Whom It May Concern,

I am writing this letter to support the establishment of the Robotics Engineering Baccalaureate. The Electrical and Computer Engineering Department plans to fully participate in the governance and operation of the program with the School of Computing and the Mechanical and Materials Engineering Department, as provided by the Structure and Governance document/agreement.

Should you require further information or have any queries, please do not hesitate to reach out to me via email at jhudgins2@unl.edu or through my phone number.

Sincerely,

Dr. Jerry L. Hudgins,
Professor and Chair

c: J. Shield
W. Srisa-an

University of Nebraska Lincoln
Department of Electrical and Computer Engineering
C209 Scott Engineering Center | P.O. Box 880511 | Lincoln, NE 68588-0511 | 402.472.3772
1110 S. 67th St. | The Peter Kiewit Institute | Omaha, NE 68182-0572 | 402.554.2288
ece.unl.edu

April 13, 2024

Subject: SoC Support for Undergraduate Robotics Engineering Program

Dear Associate Dean Riley,

The School of Computing strongly supports the proposed undergraduate Robotics Engineering Program based on the proposed curriculum and the governance plan. We are excited by the opportunity to collaborate as a partner in developing and implementing this program.

If you have any questions regarding this letter, please do not hesitate to reach out to me.

Sincerely,

Witawas Srisa-an,
Director, School of Computing
University of Nebraska Lincoln

University of Nebraska Lincoln
School of Computing
256 Avery Hall | Lincoln, NE 68588-0115 | 402.472-2401 | FAX 402.472.7767
computing.unl.edu

April 18, 2024

College of Engineering Curriculum Committee

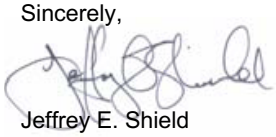
RE: Proposed Robotics Program

To Whom It May Concern:

I am pleased to offer my support for the proposed undergraduate program in Robotics Engineering. Developing this program will put UNL Engineering at the forefront of robotics education, putting us at the forefront of workforce development in this rapidly expanding field. Most robotics engineering opportunities are minors or emphasis areas at the undergraduate level, with formal degree programs confined to graduate programs. Of the Big 10 engineering programs, only the University of Michigan offers an undergraduate degree in robotics engineering, and only a few other engineering colleges offer this degree program. Thus, this program has the potential to attract students desiring a robotics degree program from the outset. The highly interdisciplinary nature of the proposed program will ensure the graduating students will be well prepared for a productive career, such as in manufacturing and other areas seeing increasing automation.

Please let me know if you have further questions.

Sincerely,



Jeffrey E. Shield
Robert W. Brightfelt Professor of Engineering
Chair, Department of Mechanical & Materials Engineering

University of Nebraska Lincoln
Department of Mechanical and Materials Engineering
W342 Nebraska Hall | Lincoln, NE 68588 | 402.472.2375
mme.unl.edu

INVEST NEBRASKA

April 15, 2024

Lance C. Perez, Ph.D., FASEE
Omaar H. Heins Professor of Electrical and Computer Engineering
Dean, College of Engineering
University of Nebraska-Lincoln
114 Othmer Hall
Lincoln, NE 68588-0642

Dear Dean Perez,

Please accept this letter in staunch support of the College of Engineering's establishment of a University of Nebraska-Lincoln (UNL) undergraduate program in Robotics Engineering.

As Nebraska's statewide venture development organization, Invest Nebraska partners with the Nebraska Department of Economic Development to assist entrepreneurs and innovators and invest in this state's most promising technology startups. Additionally, we collaborate with state partners to build the entrepreneurial infrastructure needed for early-stage companies to grow in Nebraska and compete in the 21st century.

In 2021, we partnered with the UNL College of Engineering, Metropolitan Community College, Northeast Community College, the Manufacturing Extension Partnership, Nebraska Innovation Studio, and The Combine to create a grand vision for robotics and automation in the state under the Heartland Robotics Cluster. In response to the U.S. Department of Commerce's Economic Development Administration's Build Back Better Regional Challenge (BBBRC), this cluster applied for and received a $25 million grant to begin the process of building the robotic and automation infrastructure.

The time is right to establish a UNL undergraduate program in Robotics Engineering. While preparing our BBBRC application, three major data points became evident:

- In 2021, Brookings identified Lincoln, Nebraska as one of thirteen "early adopter" metro areas in the country showing above-average involvement in AI activities.
- Nebraska has a growing robotic startup culture. Invest Nebraska has invested in several robotic startups in recent years including:
  - Virtual Incision
  - Capstone Technologies
  - Drone Amplified
  - Marble Technologies

Continued on next page

801 R Street, Suite 1
Lincoln, NE 68508
402.742.7860
InvestNebraska.com

INVEST NEBRASKA

  - Grain Weevil
  - BirdsEye Robotics
- In 2021, according to the Nebraska Public Power District, Nebraska had the fourth highest number per capita of middle-school and high-school teams participating in First, Vex, or Create robotic competitions in the country.

This last point is extremely important. Nebraska has young students in our middle schools and high schools exploring the STEM fields through a local robotic team. These students compete with their peers, share knowledge, receive mentorship, and build collaboration through teamwork. Like decades of Nebraska sports activities, robotics would have an even greater impact for our state's youth by providing students an actual pathway to careers in various STEM fields.

The establishment of an undergraduate program in Robotics Engineering will continue to demonstrate the College of Engineering's commitment to workforce development and active response to future employment demand in STEM fields.

I sincerely appreciate the collaboration between Invest Nebraska and the UNL College of Engineering these past years and look forward to an exciting future.

Best regards,

Daniel Hoffman
CEO
Invest Nebraska

801 R Street, Suite 1
Lincoln, NE 68508
402.742.7860
InvestNebraska.com

Drone Amplified, INC

1811 S. Pershing Road, Lincoln, NE 68502

www. Drone Amplified.com

531-333-2828

April 16, 2024

Dear Mark Riley,

I am writing to express my enthusiastic support for the proposed Robotics Engineering Degree Program in the College of Engineering at the University of Nebraska-Lincoln (UNL). As a professor in the School of Computing, currently on leave as CEO of Drone Amplified, I have a deep understanding of the critical need for skilled professionals in the field of robotics. Drone Amplified was started out of the UNL NIMBUS Lab and is headquartered in Lincoln. We have grown from under 10 employees to over 20 in the past year and see a continued need for more graduates with the skills and background they will develop from the proposed Robotics Engineering program.

The proposed program is well-designed and addresses the growing demand for engineers who are proficient in robotics and automation. The program's emphasis on hands-on learning, cutting-edge technology, and interdisciplinary collaboration will produce graduates who are highly sought after by employers.

The establishment of this program will not only benefit the University of Nebraska-Lincoln but also the state of Nebraska as a whole. The high-tech industry is rapidly expanding, and the availability of a skilled workforce is essential for attracting and retaining businesses. The Robotics Engineering Degree Program will help Nebraska compete for jobs and investment in this growing sector.

In addition to its economic benefits, the program will also have a positive impact on the educational landscape in Nebraska. The program will attract a significant number of students, both from within the state and beyond, who are passionate about robotics and engineering. These students will bring diverse perspectives and talents to the university, enriching the academic environment for all students.

The Robotics Engineering Degree Program has my full support and I am confident that this program will be a valuable asset to the University of Nebraska-Lincoln and the state of Nebraska. If you have any questions, please do not hesitate to contact me.

Sincerely,

Carrick Detweiler

HANOVER RESEARCH

MARKET ANALYSIS

Undergraduate Robotics Program

Prepared for the University of Nebraska – Lincoln College of Engineering

May 2021

In the following report, Hanover assesses demand for undergraduate programs in robotics, specifically highlighting demand trends nationwide. This report includes an examination of student and labor market demand, and an analysis of potential competitor programs.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

RECOMMENDATIONS

Based on an analysis of degree completions, labor market demand, and market competitors, Hanover recommends that the University of Nebraska – Lincoln College of Engineering (UNL):

DEVELOP THE PROPOSED PROGRAM AS A BACHELOR'S IN ROBOTICS ENGINEERING.

Positive student demand indicators reveal strong student interest in robotics programs, and occupational growth suggests program graduates will enjoy a stable labor market. Hanover recommends naming the program Bachelor's in Robotics Engineering based on competitor trends; just over half of reviewed programs use this title, suggesting that this name will be familiar to prospective students.

OFFER INTERNSHIP OR CO-OP OPPORTUNITIES WITHIN THE PROGRAM.

Almost all reviewed programs require experiential learning, but these requirements typically take the form of projects rather than internships. Providing students with hands-on experience in professional settings could help differentiate UNL, and better prepare graduates for the workforce.

EMPHASIZE ITS ROBOTICS LABS AND RESEARCH IN PROGRAM MARKETING.

Reviewed programs provide relatively little information about their labs and research foci. While most reviewed programs do note a robotics lab of some sort, only Worcester Polytechnic Institute provides clear information about lab research areas. Highlighting UNL's research topics and opportunities for student participation could further distinguish UNL in marketing the program.

EXECUTIVE SUMMARY

KEY FINDINGS

Robotics is a small but rapidly growing field.

Bachelor's conferrals in robotics totaled only 370 nationwide in 2019, but conferrals increased at an annualized rate of 69.3 percent. Several sources also point to robotics as a top "future" engineering field, poised to grow as robotics and automation become more embedded in a variety of industrial sectors. This data indicates that student demand for robotics is increasingly quickly, and that the field presents a strong opportunity for UNL.

Graduates of a robotics program can anticipate a stable job market.

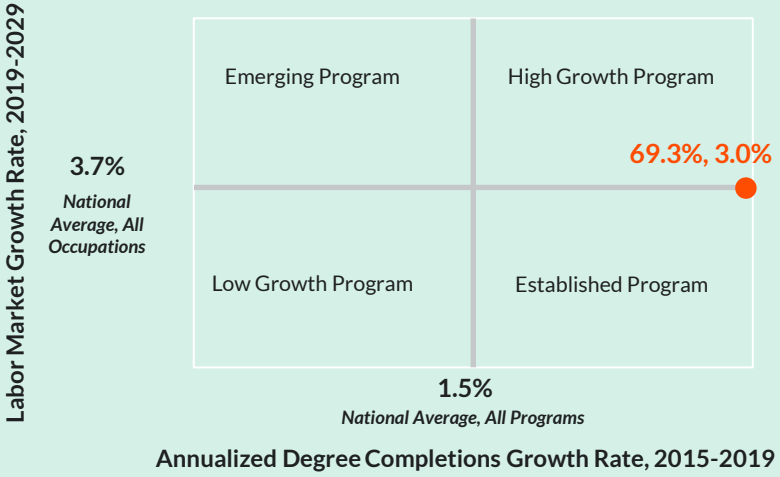
Across the nation. relevant occupation are projected to grow as fast as average from 2019 to 2029. The total number of relevant positions is also projected to be high. Moreover, the United States is home to one of the largest robotics markets in the world. These trends indicate that graduates of UNL's proposed program will enjoy strong employment demand.

Most reviewed programs require experiential learning, but internships are somewhat unique.

Nine of 10 reviewed degrees have an experiential learning requirement. Of those nine, seven require students to complete a capstone project. Only one – at the Pennsylvania College of Technology – requires an internship, though Capitol Technology University and Johnson & Wales University advertise internship opportunities. Widener University also operates an optional co-op program. These competitor trends indicate that workplace based-experiential learning would differentiate UNL's program.

NATIONAL BENCHMARK ANALYSIS

Comparison of bachelor's in robotics completions and relevant labor market to all completions and all occupations nationwide



FAST FACTS

28 Total number of relevant programs nationwide as of 2019

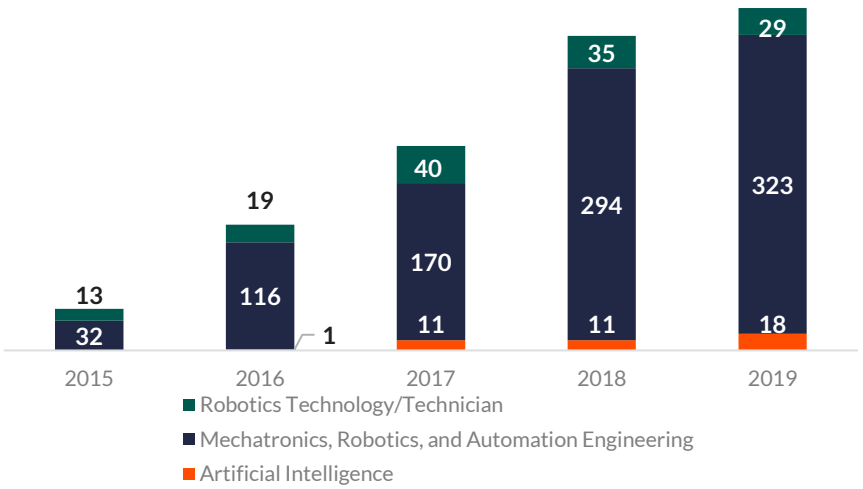
1,404 Total number of job postings for *Robotics engineers* and *Robotics technicians* nationwide over the last six months

$936 Average per credit tuition among reviewed degree programs

STUDENT DEMAND ANALYSIS

NATIONAL BACHELOR'S DEGREE COMPLETIONS

Distribution of degree completions nationwide from 2015 to 2019



TOTAL DEGREE COMPLETIONS

Aggregate degree completions by geographic level (2019)

	Nebraska	Plains	National
Artificial Intelligence	0	0	18
Mechatronics, Robotics, and Automation Engineering	0	0	323
Robotics Technology/Technician	0	0	29
Total Completions, Observed Fields	**0**	**0**	**370**
Growth Rate, Observed Fields	**--**	**--**	**69.3%**
Growth Rate, All Fields	**0.6%**	**-0.4%**	**1.5%**

Source: IPEDS. Note: The Plains region includes IA, KS, MN, MO, NE, ND, and SD

ANALYSIS

Robotics is a small but rapidly growing field.

Relevant bachelor's conferrals increased at an annualized rate of 69.3 percent from 2015 to 2019, indicating that student interest in this field has increased dramatically. However, this discipline is small; there were only 370 robotics conferrals nationwide as of 2019, and no state or regional institutions reported relevant conferrals in 2019. These trends suggest that UNL can expect strong growth in a robotics program unique to the region, but that initial enrollment may be somewhat limited.

Robotics is a "path of the future" within engineering.

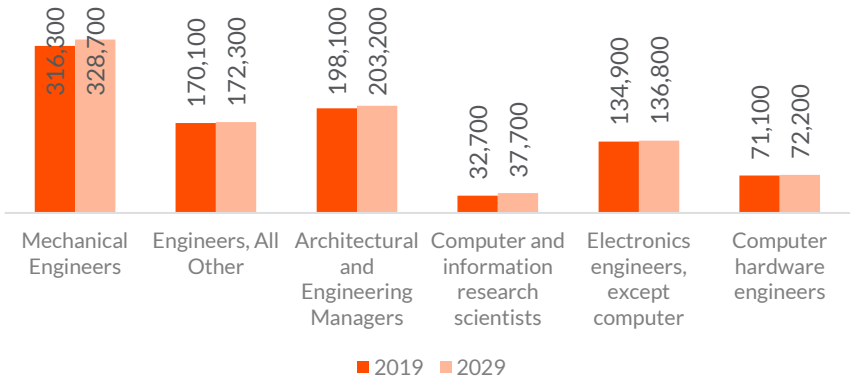
Robotics tops the University of California – Riverside's list of engineering paths positioned for future growth. UCR cites the robot-driven "fourth industrial revolution" as the key component in demand for robotics degrees. UCR also notes that robotics degrees often overlap with programs in the more traditional fields of electrical engineering, computer engineering, and computer science.

Machine Design similarly emphasizes that robotics is a forward-looking engineering field. In 2018, Machine design reported that "engineers of tomorrow need to learn how to navigate new technology fields. One such tech wave is the evolution of robotics." The growing demand for automated technologies (e.g., the Internet of Things and AI) has sparked growth in demand for robotics education. Students in a robotics program will benefit from learning about applications of the newest engineering technologies.

LABOR MARKET ANALYSIS

NATIONAL CURRENT AND PROJECTED EMPLOYMENT

Robotics-related positions nationwide as of 2019 and 2029 (projected)



TOTAL LABOR MARKET

Aggregate projected employment growth by geographic level

	Nebraska	Plains	National
Estimated Employment (2018)	2,915	47,588	923,200
Projected Employment (2028)	3,186	50,260	950,900
Employment Growth, Observed Occupations	**9.3%**	**5.6%**	**3.0%**
Total Annual Openings, Observed Occupations	**238**	**3,568**	**58,100**
Employment Growth, All Occupations	**5.5%**	**4.9%**	**3.7%**

Source: Projections Central
Note: Due to data update schedules, national data refer to the period 2019 to 2029. The Plains region includes IA, KS, MN, MO, NE, ND, and SD

ANALYSIS

Occupational projections indicate a stable job market for program graduates.

Relevant occupations are projected to grow about as fast as average nationally and regionally and faster than average in Nebraska. Positions are also expected to be numerous, with nearly one million individuals employed in these occupations nationwide by 2029. These trends suggest that pertinent engineering occupations will provide a secure labor market for program graduates.

According to the International Federation of Robotics (IFR), the United States boasts one of the largest robotics markets in the world.

The IFR's 2020 Executive Summary found that only China and Japan outpace the United States in terms of industrial robot installations. In addition, the United States maintained this strong position in the industrial robot market despite an overall decrease in robot installations worldwide from 2018 to 2019. The IFR also provides information about which industries use the most robots. As of 2019, the top sectors for robot installations are:

- Automotive
- Electrical/electronics
- Metal and machinery
- Plastic and chemical products
- Food

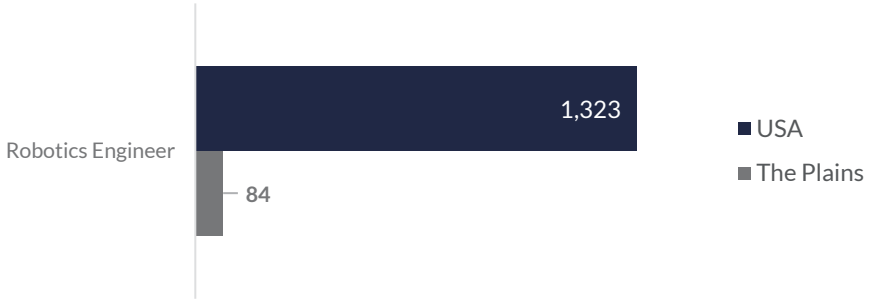
The use of robotics in the food industry is a positive sign for UNL's interest in agricultural robotics. UNL should consider opportunities for robotics related to the automotive and electronics industries as well.

NOTE: Long-term projections for Robotics engineers *and* Robotics technicians *are unavailable, but job postings for these fields are examined on the following page.*

REAL-TIME JOB POSTINGS INTELLIGENCE

TOP ROBOTICS-RELATED JOB TITLES

National robotics-related positions by geography



TOP SKILLS AND PROGRAMS

Top Skills

- Robotics (544)
- Computer Programming/Coding (534)
- Python (417)
- C++ (267)
- Linux (183)
- Machine Learning (140)
- MATLAB (126)

Top Programs

- Computer Science (344)
- Electrical Engineering (176)
- Engineering (172)
- Mechanical Engineering (169)
- Computer Engineering (81)
- Robotics (74)
- Electrical (44)

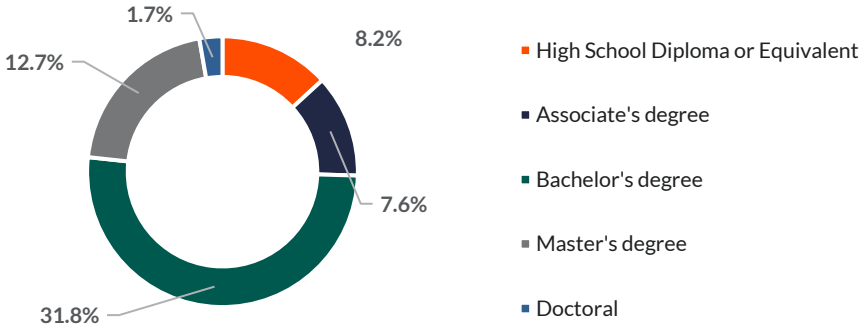
Note: For this analysis, Hanover retrieved job postings data for *Robotics Engineers* from JobsEQ, a proprietary database providing real-time job postings aggregated from thousands of websites. (Note that JobsEQ is able to provide information about more detailed occupational categories). All data reflect the 180-day period as of May 2021.

ANALYSIS

Nationwide, employers advertised a total of 1,323 relevant job postings for robotics engineers over the past six months, and 84 in the Plains region.

In the plains region, top locations included St. Louis, MO, Iowa, and Minnesota. Educational attainment data indicates that a bachelor's is the appropriate degree level for this program, further confirming demand for UNL's proposed degree. Information about top skills and programs shows that robotics engineers need strong backgrounds in programming and computer science in addition to engineering skills.

EDUCATION REQUIREMENTS



Note: 532 listings did not specify educational attainment requirements.

TOP NATIONAL EMPLOYERS

- iRobot
- Johnson &Johnson
- Nvidia
- Amazon
- Carnegie Mellon
- Apple
- TuSimple
- Bosch Group
- Georgia Tech Research Institute

COMPETITOR ANALYSIS

ANALYSIS

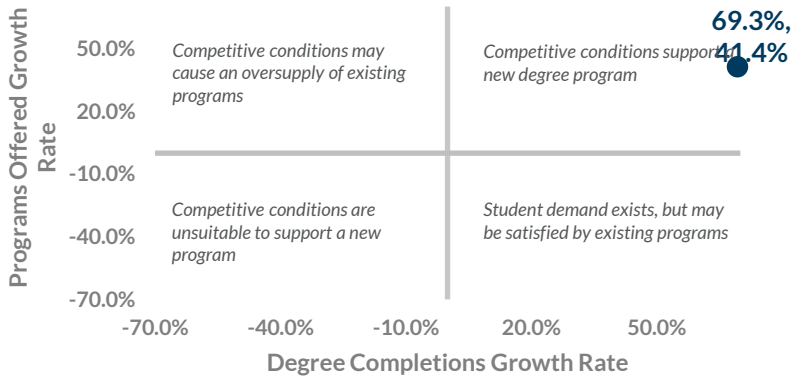
Market conditions for a new robotics engineering bachelor's are favorable.

Both degree conferrals and programs in robotics increased from 2015 to 2019, indicating that new programs are opening in response to rising student demand. These trends, particularly when combined with the dearth of programs in UNL's state and region, suggest that UNL has the opportunity to be a first mover in a rapidly growing field.

To provide a more detailed picture of the competitive landscape, Hanover benchmarked 10 bachelor's degree programs nationwide. Given the limited number of robotics bachelor's degrees, Hanover conducted an internet scan for the most relevant programs based on title and curriculum.

NATIONAL MARKET SATURATION

Do competitive conditions nationwide support an additional bachelor's program in robotics?



REVIEWED PROGRAMS

Institution	Program
Capitol Technology University *Laurel, MD*	BS in Mechatronics and Robotics Engineering Technology
Grand Canyon University *Phoenix, AZ*	BS in Engineering - Robotics Emphasis
Johnson & Wales University *Providence, RI*	BS in Robotics Engineering
Miami University *Oxford, OH*	BSE in Robotics Engineering
Millersville University *Millersville, PA*	BS in Automation & Intelligent Robotics Engineering Technology

Institution	Program
Pennsylvania College of Technology *Williamsport, PA*	BS in Automation Engineering Technology: Robotics and Automation
University of Hartford *West Hartford, CT*	BS in Robotics Engineering
University of Michigan – Dearborn *Dearborn, MI*	BSE in Robotics Engineering
Widener University *Chester, PA*	BS in Robotics Engineering
Worcester Polytechnic Institute *Worcester, MA*	BS in Robotics Engineering

PROGRAM TRENDS

NAMING CONVENTIONS

Nine of 10 reviewed programs contain the phrase "robotics engineering" or "robotics engineering technology" somewhere in the course title. Six reviewed programs are simply bachelor's in robotics engineering. This pattern indicates that the name robotics engineering will best most familiar to prospective students.

CREDIT REQUIREMENTS

127

Benchmarked programs require students to complete an average of 127 credits to earn the degree (not including Miami University and WPI, which have unusual credit reporting structures). Pennsylvania College of Technology and the University of Hartford require the most credits at 131, whereas Millersville University requires only 120.

DURATION

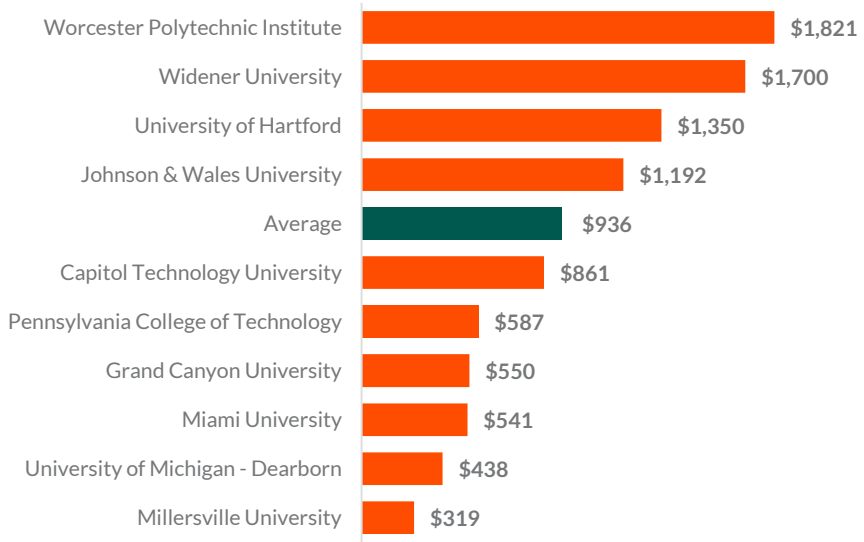
Reviewed programs require four years to complete. Though robotics engineering programs have an average credit requirement slightly above the standard 120 for a bachelor's, this structure does not appear to affect completion timelines.

CURRICULUM

Reviewed programs have strict structures, with relatively little room for electives. In general, curricula combine mechanical engineering, electrical engineering, and computer science. See the program benchmarking for complete curriculum lists.

(PER-CREDIT) TUITION

Tuition ranges from $319 per credit at Millersville University to $1,821 per credit at Worcester Polytechnic Institute. If UNL develops a robotics engineering degree, a tuition rate around or lower than $936 per credit will be cost competitive.



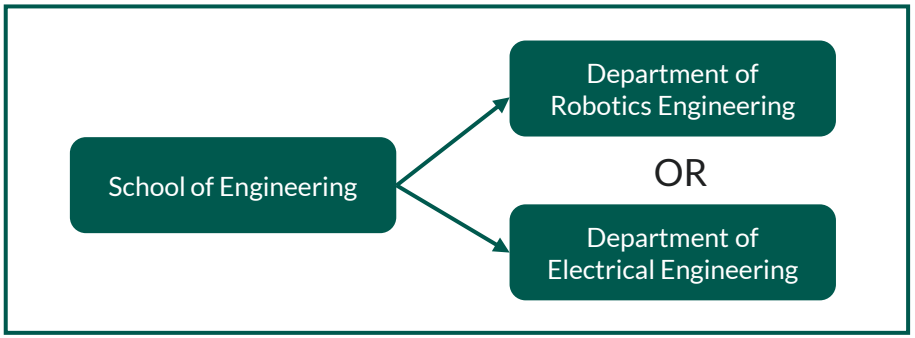
SPOTLIGHT: SPECIALIZATIONS

Only one reviewed program – at Miami University – reports specializations within its robotics program. Miami's BSE offers tracks in automation, intelligent systems, and general robotics.

PROGRAM TRENDS

ACADEMIC HOUSING

All programs are housed in schools or divisions of engineering. Where department level-information is available, institutions appear to have dedicated robotics engineering departments or house programs in the electrical engineering department. Institutions note that these programs are interdisciplinary (typically encompassing elements of mechanical engineering, electrical engineering, and computer science) but typically do not provide specific examples of interdepartmental collaboration.



RESEARCH

Reviewed programs provide relatively little information about research, though six mention robotics-related labs. WPI, which provides the most detailed information about its labs, mentions research opportunities in:

Adaptive and Intelligent Robotics	*Music, Perception, and Robotics*	*Manipulation and Environmental Robotics*	*Human-Inspired Robotics*
Computational Intelligence and Bionic Robotics	*Control and Intelligent Robotics*	*Novel Engineering of SWARM Technologies*	*Automation and Interventional Medicine*

EXPERIENTIAL LEARNING

Nine of 10 reviewed programs require an experiential learning component as a capstone course. Project requirements are the most common form of experiential learning, but some programs also offer internship or directed study opportunities. Providing an internship could help distinguish UNL's program.

7 programs require capstone projects

3 programs require or offer internships

1 program offers directed study

CAREER OUTCOMES:

Reviewed programs market occupations related to electrical, mechanical, and computer engineering, as well as applications to the medical, aerospace, and manufacturing industries.

Sample Occupations	Sample Industries
•Automation engineer •Robotics engineer •R&D product development engineer	•Artificial limb development •Manufacturing automation •Outer space probe development

SPOTLIGHT: PARTNERSHIPS

Only one institution, Widener University, advertises external partnerships. Widener provides an optional co-op program that allows students to gain a year of work experience while still working towards their degree.

PROGRAM BENCHMARKING

Hanover identified relevant programs via an internet scan focusing on degree titles and curriculum. Note that tuition reflects in-state rates where applicable. Semester or annual tuition rates were converted assuming a course load of 15 credits per semester.

Institution	Program	Academic Housing	Credits	Duration	Research Areas	Curriculum	Experiential Opportunities	Partnerships	Career Outcomes	Per-Credit Tuition
Capitol Technology University *Laurel, MD*	BS in Mechatronics and Robotics Engineering Technology	Engineering and Engineering Technologies Division	125	4 years	--	**Courses in:** ▪ Mechatronics ▪ Electronics and engineering ▪ Computer science ▪ Robotics ▪ Full curriculum	▪ Required capstone project (report or project) ▪ Internship opportunities	--	▪ Mechatronics Technology ▪ Robotics Technician ▪ Industrial Technologist ▪ Project Coordinator ▪ Applications Technologist	$861
Grand Canyon University *Phoenix, AZ*	BS in Engineering - Robotics Emphasis	College of Science, Engineering, and Technology	128	4 years	--	**Courses in:** ▪ Advanced mathematics ▪ Engineering ▪ Full curriculum	▪ Two capstone project courses	--	▪ Design artificial limbs ▪ Develop automated manufacturing systems ▪ Design outer space probes ▪ Produce robotic surgical platforms	$550
Johnson & Wales University *Providence, RI*	BS in Robotics Engineering	Engineering and Design Division	122	4 years	• Several clubs (robotics, tech and entrepreneurship) • Computing machinery association	**Courses in:** ▪ Robotics ▪ Automation ▪ Mechatronics engineering ▪ Full curriculum	▪ Requires 6 credits of experiential education (directed study, internship, or project)	--	▪ Computer hardware engineer ▪ Electro-mechanical technician ▪ Industrial designer	$1,192

Source: Institutional Websites (see embedded hyperlinks)

PROGRAM BENCHMARKING

Hanover identified relevant programs via an internet scan focusing on degree titles and curriculum. Note that tuition reflects in-state rates where applicable. Semester or annual tuition rates were converted assuming a course load of 15 credits per semester.

Institution	Program	Academic Housing	Credits	Duration	Research Areas	Curriculum	Experiential Opportunities	Partnerships	Career Outcomes	Per-Credit Tuition
Miami University *Oxford, OH*	BSE in Robotics Engineering	College of Engineering and Computing – Department of Electrical and Computer Engineering	108*	4 years	General electrical and computer engineering lab	**Specializations in:** ▪ Automation ▪ Intelligent Systems ▪ General Robotics **Courses in:** ▪ Mechanical engineering ▪ Electrical engineering ▪ Computer engineering ▪ Computer science ▪ Full curriculum	▪ Two senior design project courses	--	--	$541
Millersville University *Millersville, PA*	BS in Automation & Intelligent Robotics Engineering Technology	College of Engineering and Technology – Department of Applied Engineering, Safety, and Technology	120	4 years	Labs for adaptive computing, automatics, CADD, electronics, fluid power, humanoid, intelligent machines, materials processing, and rapid prototyping	**Courses in:** ▪ Electronics ▪ Control systems ▪ Mechanical systems ▪ Computer programming ▪ Full curriculum	--	--	▪ Software engineers ▪ Robotics programmers ▪ Process engineers ▪ Robotics technicians	$319
Pennsylvania College of Technology *Williamsport, PA*	BS in Automation Engineering Technology: Robotics and Automation	School of Engineering Technologies	131	4 years	Labs for robotics, electronics engineering, and computer engineering	**Courses in:** ▪ Electrical/electronics ▪ Mechatronics ▪ Robotics ▪ Vision systems ▪ Networking ▪ Automated systems ▪ Software applications ▪ Full curriculum	▪ Required Internship	--	▪ Technical sales ▪ Automation integrator ▪ Controls tech ▪ Mechanical tech ▪ Controls engineer	$587

Source: Institutional Websites (see embedded hyperlinks)
*Miami University does not include general education requirements in its credit total

PROGRAM BENCHMARKING

Hanover identified relevant programs via an internet scan focusing on degree titles and curriculum. Note that tuition reflects in-state rates where applicable. Semester or annual tuition rates were converted assuming a course load of 15 credits per semester.

Institution	Program	Academic Housing	Credits	Duration	Research Areas	Curriculum	Experiential Opportunities	Partnerships	Career Outcomes	Per-Credit Tuition
University of Hartford *West Hartford, CT*	BS in Robotics Engineering	College of Engineering, Technology, and Architecture	131	4 years	Two new robotics labs	**Courses in:** ▪ Computer engineering ▪ Electrical engineering ▪ Mechanical engineering ▪ Sensing ▪ Computer science ▪ Full curriculum	• Two capstone design courses	--	▪ Industrial robotics ▪ Factory automation and advanced manufacturing	$1,350
University of Michigan – Dearborn *Dearborn, MI*	BSE in Robotics Engineering	College of Engineering and Computer Science – Department of Electrical and Computer Engineering	125	4 years	--	**Courses in:** ▪ Electrical engineering ▪ Computer engineering ▪ Mechanical engineering ▪ Robotics ▪ Automotive ▪ Full curriculum	• Two senior design courses	--	▪ Robotics engineer	$438
Widener University *Chester, PA*	BS in Robotics Engineering	School of Engineering – Department of Robotics Engineering	130	4 years	New robotics lab	**Courses in:** ▪ Smart sensors/controls ▪ Electrical engineering ▪ Mechanical engineering ▪ Full curriculum	• Two senior project courses	• Optional co-op that provides on year work experience	▪ Robotics engineer ▪ Software engineer ▪ Automation engineer ▪ R&D engineer	$1,700
Worcester Polytechnic Institute *Worcester, MA*	BS in Robotics Engineering	School of Engineering – Department of Robotics Engineering	15*	4 years	22 robotics labs	**Courses in:** ▪ Computer science ▪ Electrical and computer engineering ▪ Mechanical engineering ▪ Full curriculum	• Major qualifying project	--	▪ Software engineer ▪ Hardware engineer ▪ Mechanical engineer ▪ R&D product development engineer	$1,821

Source: Institutional Websites (see embedded hyperlinks)
*WPI uses a non-standard credit system

HANOVER RESEARCH

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University of Nebraska-Lincoln
New Undergraduate Major or Degree

I. Descriptive Information

Name of Institution Proposing New Major or Degree			
University of Nebraska-Lincoln			
Name of Proposed Major or Degree			
Robotics Engineering			
Degree to be Awarded to Graduates of the Major			
Bachelor of Science			
Other Majors or Degrees Offered in this Field by Institution			
Robotics Minor			
CIP Code: 6 digit *[Browse here: http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55]*			
14.4201, Mechatronics, Robotics and Automation Engineering			
Subject Code: 4 characters			
ROBO			
Administrative Units for the Major or Degree			
College of Engineering Dean's Office			
Proposed Delivery Site			
Lincoln, NE			
Program will be Offered *[full program, not individual courses]*			
X On-campus only	Distance only	Both (on-campus and distance)	
Program leads to licensure or certification			
no	X yes	If yes, explain: will seek ABET accreditation	

Curriculum Categories and Number of Credit Hours (must equal 120 credit hours)	
Existing or repackaged curricula:	100 credit hours
Revised or redesigned curricula:	0 credit hours
New curricula:	28 credit hours

Proposed Date the New Major or Degree will be Initiated
Fall 2025

II. Details

A. **Purpose of the Proposed Major or Degree:**
The Robotics Engineering undergraduate degree program is designed to meet the growing demand for skilled professionals in this rapidly developing field. Robotics and automation have become integral components to numerous Nebraskan industries including agriculture, manufacturing, and healthcare. At present, there are nearly 100 unfilled job openings for robotics professionals in Nebraska, highlighting the demand for industry professionals with this specialized skillset. Identifying the importance of developing robotics and automation in the region, a generous grant from the Department of Commerce's Economic Development

Administration allows for the hiring of several key positions necessary to build out the proposed program.

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 College of Engineering Dean's office with support from the School of Computing, Electrical and Computer Engineering Department, and the Mechanical and Materials Engineering Department. A core of courses including multiple offerings from each discipline with three possible emphasis tracks will allow students to specialize in applications of one of these three foundational disciplines.

The degree program in Robotics Engineering contains all the necessary elements to obtain accreditation from ABET, (formerly the Accreditation Board for Engineering and Technology) and to prepare students for professional licensure. The proposed program is 128 credit hours; thus, an exemption to the Board of Regents' 120 credit hour policy is requested, as discussed in Section B. This is the same number of credit hours currently required for the B.S. in Mechanical and Materials Engineering and is in line with other robotics engineering programs in the Big Ten conference (University of Michigan requires 128 credit hours).

B. **Description of the Proposed Major or Degree:**

The program's primary educational objectives (PEOs) are described here. The educational program in robotics engineering is designed so that, within a few years of graduation, our Robotics Engineering graduates will:

1. Have established successful careers in robotics, automation, or related fields, demonstrating their ability to apply principles of robotics engineering to responsibly solve complex problems.
2. Engage in continuous learning and professional development to stay abreast of advancements in robotics and emerging technologies.
3. Demonstrate leadership, ethical conduct, and effective communication in multidisciplinary teams, contributing to the progress of the robotics profession and society.
4. Contribute to the advancement of robotics and automation through innovation, research, or entrepreneurial endeavors, showcasing the ability to push the boundaries of knowledge and technology in the field.

The Student Learning Outcomes listed below will be assessed on a regular basis, pursuant to accreditation requirements through the Accreditation Board for Engineering and Technology (ABET). The assessment results will be reviewed regularly by our faculty to ensure that at the time of graduation, Robotics Engineering students 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 curriculum is also designed to meet program-specific ABET requirements, including:

- both breadth and depth across the range of engineering science, computer science, and engineering design topics implied by the title and objectives of the program;
- design, analysis, operation and improvement of integrated systems that produce or supply products or services in an effective, efficient, sustainable and socially responsible manner;
- utilization of real-world experiences and business perspectives; and
- topical areas of productivity analysis, operations research, probability, statistics, engineering economy, and human factors.

In this section, the admission criteria and selection procedures for students seeking admission to the degree program are described.

COLLEGE ENTRANCE REQUIREMENTS

Freshman Admission Requirements

In addition to university requirements, College of Engineering applicants (except those applying to the Computer Science* major) must meet the following requirements below:

4 units of high school math, including:

- 1 unit of Algebra I
- 1 unit of Algebra II
- 1 unit of Geometry
- 1 unit of Pre-Calculus/Trigonometry or Calculus

3 units of high school science (must include):

- 1 unit of physics
- 1 unit of chemistry

If the minimum admission has not been met, a student may be admitted based on an individual review of the application:

- 24 ACT Composite (SAT equivalent score of 1180) or
- 24 ACT MATH sub-score (or 580 SAT Math score) or
- 3.5 cumulative high school GPA

Transfer Student Admission Requirements

- 2.0 last semester GPA
- 2.5 cumulative GPA
- Must be calculus-ready

International Freshmen:

- Must meet the Freshmen Admissions Requirements, and
- Must meet the minimum English proficiency requirements for the University

International Transfer:

- 2.5 Post-Secondary Cumulative GPA (combined from all schools attended)

- AND 2.0 Most recent term GPA
- Must be calculus-ready
- Must meet the minimum English proficiency requirements for the University

Readmit Students

- Students who left in good standing (RE and RI) will be admissible upon reapplication.
- Students who were academically dismissed will be evaluated based upon a review of a readmit questionnaire and documentation.

Deficient Students

Any student with deficiencies in the above areas will be reviewed by an admissions review committee to determine admissibility despite any deficiencies.

English Proficiency Requirement

In order to gain admission into the University of Nebraska-Lincoln all non-native English speakers must provide confirmation of English proficiency. The below scores grant English proficiency to the University of Nebraska-Lincoln. While a student may gain admission to the University of Nebraska-Lincoln based upon these requirements, that does not assure admission into a college. Each college may choose to raise their college requirements above the university level.
The current, approved English proficiency requirements are:

- TOEFL Internet-Based: 70 (20 Writing Subscore)
- TOEFL Paper-Based: 523 composite
- IELTS: 6.0 composite (5.5 Writing Subscore)
- University of Nebraska–Lincoln English Language Test (ELT): 74
- ACT English Subscore: 20
- SAT Reading Subscore: 26
- Graduation from a high school in the United States
- Completion of 30 semester hours (or equivalent) of coursework at a college or community college in the United States
- Successful completion of the UNL Credit English for Academic Purposes Program with a semester GPA over a 3.0 or a semester GPA above a 2.0 with an approved test score

Course Code and Name for Required Courses	Major/Degree Credit Hours	Prerequisites, if applicable	New Course and Lab Fees
Term 1	14		
MATH 106 Calculus I	5	MATH 102 or MATH 103	
ROBO 100 Introduction to Robotics	3		
CSCE 155E Computer Science I	3		
ACE 2 (select from ENGR 100 or COMM 286)	3		
ENGR 010 Freshman Engineering Seminar	0		
Term 2	16		
MATH 107 Calculus II	4	MATH 106	
PHYS 211 Physics I	4	MATH 106	
PHYS 221Physics I Lab	1		

ROBO 150 Robotics Tools	3		$25
CSCE 156 Computer Science II	4	CSCE 155	
Term 3	18		
ACE 1 (select from JGEN 200, JGEN 120, JGEN 300, ENGL 151)	3		
PHYS 212 Physics II	4	MATH 107; PHYS 211	
PHYS 222 Physics II Lab	1		
ROBO 200 Robotics Analysis Core	3	MATH 107 or equivalent	
CSCE 336/ECEN 220 Embedded Systems	3	CSCE 155E; ECEN 103	
ECEN 215 Electronics and Circuits I	3	MATH 208 or equivalent	
ECEN 235 Electrical Lab I	1		
ENGR 020 Sophomore Engineering Seminar	0		
Term 4	17		
MATH 221 Differential Equations	3	MATH 107	
MECH 223 Engineering Statics	3	MATH 107; PHYS 211	
ECEN 345 Mobile Robotics	4	MATH 107 or equivalent	
CSCE 311 Data Structures	3	CSCE 155	
ECEN 216 Electronics and Circuits II	3	ECEN 215	
ECEN 236 Electrical Lab II	1		
Term 5	18		
ECEN 305/MECH321 Statistics and Data Analysis	3	MATH 208 or equivalent	
MECH 373 Engineering Dynamics	3	MECH 223; MATH 208 or equivalent	
ROBO 302 Robotic Design and Control	3	MATH 221	$50
ROBO 303 Robotic Software and Algorithms	3	CSCE 155E	
ECEN 304 Signals and Systems I	3	ECEN 216; MATH 221	
Any ACE 5,6,7,9	3		
Term 6	15		
MECH 350 Dynamics and Control of Engineering Systems	3	MECH 373; ECEN 211; CSCE 155; MATH 314	
ROBO 350 Robotic System Integration	3		$50
Any ACE 5,6,7,9	3		
Elective	3		
Elective	3		
Term 7	16		

ROBO 299 Robotic Career Experience	1		
ROBO 446 Capstone I	3		
Any ACE 5,6,7,9	3		
Elective	3		
Elective	3		
Elective	3		
Term 8	14		
ROBO 447 Capstone II	3	ROBO 446	
Any ACE 5,6,7,9	3		
Elective	3		
Elective	3		
Elective	2		
Take 23 elective credits from one of the following focus areas			
Mechanical Electives			
MECH 230 Introduction to Mechanical Engineering Design	3	MECH 130; MECH 325	
MECH 342 Kinematics and Dynamics of Machinery	3	MECH 130; MECH 373	
MECH 453 Robotics Kinematics and Design	3	MECH 350	
MECH 450 Mechanical Engineering Control Systems Design	3	MECH 350	
MECH 457 Mechatronic Systems Design	3	ECEN 231; MECH 350	
MECH 437 Biomedical Device Design	3	MECH 223; MECH 373	
MECH 442 Intermediate Kinematics	3	MECH 342	
MECH 449 Advanced Dynamics	3	MECH 373; MATH 221	
MECH 492 Special Topics	1-6		
Any other advisor approved 400 Level MECH course			
Electrical Electives			
ECEN 370 Digital Logic Design	3	ECEN 103; CSCE 230	
ECEN 327 Discrete Systems Lab	1	ECEN 220	
ECEN 433/CSCE 230 Microprocessor System Design	4	ECEN 305; CSCE 235	
ECEN 463 Digital Signal Processing	3	ECEN 304	
ECEN 435 Embedded Microcontroller Design	4	ECEN 433; ECEN 305	
ECEN 428 Power Electronics	3	ECEN 304; ECEN 316	

ECEN 444 Linear Control Systems	3	ECEN 304	
ECEN 464 Digital Communication Systems	3	ECEN 462	
ECEN 492 Special Topics	1-6		
Any other advisor approved 400 Level ECEN course			
Computer Electives			
CSCE 436 Advanced Embedded Systems	3	CSCE 336 or ECEN 220	
CSCE 230/ECEN 433 Computer Organization	4	ECEN 305; CSCE 235	
CSCE 454 Human-Robot Interaction	3	CSCE 156	
CSCE 473 Computer Vision	3	CSCE 156; CSCE 311	
CSCE 361 Software Engineering	3	CSCE 311	
CSCE 476 Introduction to Artificial Intelligence	3	CSCE 311	
CSCE 460 Software Engineering for Robotics	3	CSCE 361	
CSCE 351Operating System Kernels	3	CSCE 230; CSCE 311	
CSCE 492 Special Topics	1-6		
Any other advisor approved 400 Level CSCE course			

The proposed program requires a total of 128 credit hours; an exemption to the Board of Regent's 120 credit hour policy is thus requested. As with other engineering disciplines, this number of credit hours is needed to simultaneously meet the UNL Achievement-Centered Education (ACE) and ABET requirements, and to adequately prepare graduates for a career in robotics engineering which can require professional licensure. The proposed curriculum is designed to meet these needs. In addition, the curriculum content is comparable to programs such as University of Michigan (128 credit hours); a Hanover analysis showed 127 credit hours as most typical. The total number of credits is also in line with other engineering majors at UNL (Table II.2).

Table II.2. Credit Hours Required for Other ABET-Accredited B.S. Degrees in the UNL College of Engineering

Degree	Credit Hours
B.S. Agricultural Engineering	123
B.S. Computer Engineering (Omaha)	124
B.S. Electrical Engineering	124
B.S. Software Engineering	123
B.S. Environmental Engineering	125
B.S. Construction Engineering	125
B.S. Computer Engineering (Lincoln)	126
B.S. Biological Systems Engineering	127
B.S. Industrial Engineering (IN DEVELOPMENT)	124
B.S. Mechanical Engineering	128
B.S. Architectural Engineering	128
B.S. Civil Engineering	126

B.S. Chemical Engineering	132

Advising

Freshman students will initially be advised by professional advisors within Engineering Student Services (ESS), a College-wide advising center with subject-area expert advisors, during New Student Enrollment. These advisors ensure that students enroll in the appropriate courses by having an understanding of the prerequisites and curriculum, and will be an invaluable resource during the freshman and sophomore years. Faculty advisors will begin advising students in the second year (at the time of professional admission), transitioning from the ESS advisors, guiding them through course selection for chosen career paths and providing counsel on career paths, internships, and other professional development opportunities. Students will be assigned advisors based on sub-discipline interests, matched with faculty with appropriate expertise. ESS is in Kiewit Hall, occupying a large section of the 5th floor.

Accreditation

This program will seek accreditation from ABET (formerly the Accreditation Board for Engineering and Technology), the international standard for engineering programs. All other eligible College of Engineering degree programs have ABET accreditation. Accreditation is based on program educational objectives, student outcomes, program assessment protocols, curriculum, faculty, facilities and institutional support.

PROGRAM CRITERIA FOR MECHATRONICS, ROBOTICS, AND SIMILARLY NAMED ENGINEERING PROGRAMS

Co-Lead Societies: American Society of Mechanical Engineers, Institute of Electrical and Electronics Engineers

These program criteria apply to engineering programs that include “mechatronics”, “robotics”, or similar modifiers in their titles.

1. Curriculum

   The structure of the curriculum must provide both breadth and depth across the range of engineering topics implied by the title of the program.

   The curriculum must include:

   A) Differential calculus, integral calculus, differential equations, linear algebra, and calculus-based physics

   B) Engineering topics including mechanical systems, electronic circuits, control systems, and computer science, as well as the application of sensors, actuators, and embedded controllers

   C) Modeling, analysis, and design of systems or processes that integrate hardware and software to control mechanical systems.

2. Faculty

   The program must demonstrate that faculty members responsible for upper-level courses in engineering topics are maintaining currency in their specialty area(s).

Course Codes

The “ROBO” Course Subject Code will need to be created. Ten new courses will need to be developed along with use of existing CSCE, ECEN, and MECH courses

C. **Plans for Implementation**

The plan for implementation is the following. We have hired two Assistant Professors of Practice with three year offers. Funding from EDA will provide support for more than two years; College of Engineering resources will be utilized at the conclusion of the EDA support.

We aim to begin with a "soft launch" in this first year in order to bring in a small number of students at a time to facilitate development and expansion of curriculum. We will offer the first class in Fall of 2024 under the ENGR prefix and will recruit approximately 15 students this summer from the entering class. These students will begin as Engineering (no major selected), take one ENGR Robotics focused introduction course in the Fall and one ENGR Robotics tools focused course in the Spring. In AY26, presuming we have gained approval of the major, we will enhance recruiting to bring in approximately 50 students. We do anticipate some attrition from ROBO into traditional ENGR majors and have designed the first year of the curriculum to facilitate ease of transfer from ROBO into ME, EE, and CS programs. We anticipate graduating on the order of 25 students each year. At steady state we anticipate on the order of 125 students in the program. In the event that the major is substantially more attractive than we predict, we may need to limit the number of students who progress into the upper division courses or to bring on additional teaching capacity.

The two POP's will develop course content and curriculum in collaboration with established faculty and ensure that the newly designed courses interface properly with pre-requisite courses and courses that are downstream.

Advising of the students will begin with advisors from Engineering student services. As students progress through the program, we will increasingly utilize the experience of the POP's along with Robotics focused faculty in COE.

III. Review Criteria

A. **Centrality to UNL Role and Mission**

As stated on the UNL Role and Mission webpage: "The University of Nebraska–Lincoln was chartered by the Legislature in 1869 and serves as both the land-grant and the comprehensive public university for the State of Nebraska." That page also states that "The university's graduates and its faculty and staff are major contributors to the economic and cultural development of the state."

The University provides quality education and workforce development for the economic growth of the state. Despite the job opportunities open to robotics engineers, there are currently no degree programs in the state of Nebraska dedicated to serving this need. UNL, and specifically the College of Engineering as the only engineering college in the state, is well-positioned to fill the void. The teaching of this degree program will add to the intellectual capital of the state, and the research associated with the program will increase the knowledge base of the field. The degree program is set up to train robotics engineers to solve today's problems, while being flexible enough to address tomorrow's problems as well. It will thus fulfill the mission of the University of Nebraska to have its graduates, faculty, and staff be major contributors to the state's economic and cultural development.

B. **Relationship of the proposal to the NU 5-year strategy**

The proposed ROBO degree aligns very well with the NU System 5-year strategy particularly since the impetus for developing the program is to meet the growing workforce needs in Nebraska for individual skilled in robotics, automation, mechatronics, and related areas. Partnerships with the private sector have been and will increasingly be utilized in the implementation of this program in part through the inclusion of a Career Exploration course (1 Credit hour ROBO 299) and the ongoing discussions with local and regional employers on course content.

The ROBO program will by design have numerous experiential learning activities both within the required curriculum and through extracurricular activities that are anticipated (like Robotics competitions). The skills will also align well with development of micro credentials in manufacturing,

embedded systems, AI/ML, and other areas that would enhance the student skills. This program will be fiscally responsible as it will rely in large part on courses that already are being taught in support of established programs. Our approach is quite efficient needing only two new faculty to create a unique program.

C. **Consistency with the Comprehensive Statewide Plan for Post-Secondary Education**

This plan aligns very well with the CCPE statewide plan through meeting the need for a program to support local and regional industry and leveraging student interest in Robotics. There are no competing programs within 500 miles of the UNL campus and is likely to be an attractant to bring students from surrounding states to UNL. An added advantage to technology development is that BS graduates are likely to be very strong candidates for graduate programs including those for which UNL faculty have gained federally sponsored research support.

As part of the EDA-funded activity, we have been working with Nebraska's Metro Community College and Northeast Community College as they also develop curriculum in robotics in support of Associate Degree programs. We see these groups as partners and are exploring mechanisms for their graduates to matriculate into our BS program. There are challenges in making this seamless for the students, but there is good communication and interest in working collaboratively.

D. **Evidence of Need and Demand**

1. Need:

In 2021 the UNL COE contracted with Hanover to perform a market analysis for the development of an undergraduate BS program in Robotics Engineering. Their conclusions were that:

- A national market analysis indicated a favorable condition in support of a new degree program due to both a high demand from students and an under-supply of available programs.
- Job postings show 1,323 open advertised positions across the U.S. and currently 84 such positions in the Great Plains area; both of these are anticipated grow substantially. ZipRecruiter also shows 94 local job openings. The BS degree appears to be the ideal target educational level based on the degree and skill sets requested in advertised positions.
- The discipline is small compared with established programs in Mechanical Engineering, Electrical Engineering, and Computer Science, however, it is a rapidly growing field with conferrals increasing 69.3% from 2015-2019. Hanover anticipates that UNL could expect strong growth due to there being no competing programs in the Great Plains region.
- The degree name, "Robotics engineering" is the most common title and will be most familiar to prospective students.
- Hanover reported that typical credit requirements were 127 student credit hours over four years of study and curricula are a combination of mechanical engineering, electrical engineering, and computer science. There is often an emphasis on experiential learning through capstone projects, internships, and directed study.
- Programs that Hanover reviewed have strict structures (that is, with few electives). Only one program they reviewed had specializations and these were for automation, intelligent systems, and general robotics.

While preparing our BBBRC application that funded the Heartland Robotics Cluster, our partner Invest Nebraska identified three major data points in support of developing a BS degree in robotics engineering:

- In 2021, Brookings identified Lincoln, Nebraska as one of thirteen "early adopter" metro areas in the country showing above-average involvement in AI activities.

- Nebraska has a growing robotic startup culture. Invest Nebraska has invested in several robotic startups in recent years including:
  - Virtual Incision
  - Capstone Technologies
  - Drone Amplified
  - Marble Technologies
  - Grain Weevil
  - BirdsEye Robotics
- In 2021, according to the Nebraska Public Power District, Nebraska had the fourth highest number per capita of middle-school and high-school teams participating in First, Vex, or Create robotic competitions in the country. These young students would be our future UNL enrollees in Robotics Engineering.

According to Invest Nebraska, this last point is extremely important. Nebraska has many young students in our middle schools and high schools exploring the STEM fields through a local robotics team. These students compete with their peers, share knowledge, receive mentorship, and build collaboration through teamwork. Like decades of Nebraska sports activities, robotics would have an even greater impact for our state's youth by providing students a robust pathway to careers in various STEM fields.

2. Demand:

Nebraska has a strong student participation in a number of competitive robotic organizations with interest at all levels of primary education. At present, organizers of these groups have expressed dissatisfaction with the lack of opportunities for those deeply involved in robotics to pursue this passion as a career. Since the HRC project launched in 2022, we have supported on campus activities of student robotic competitions from VEX and FIRST Robotics. These competitions in 2024 brough 62 VEX teams comprised of 230 participants while the FIRST competition brought 76 teams with 576 participants to the UNL campus. Some of these competitors are likely to enter UNL and COE through traditional programs in Mechanical Engineering, Electrical Engineering, and Computer Science. We see Robotics Engineering as a potential destination program that encourages students (and especially those from Nebraska, Iowa, Kansas, South Dakota) to come to UNL and migrate to the program that best fits their career aspirations. The differentiator is the Robotics Engineering is designed as an application-oriented degree program in a manner similar to that of Agriculture Engineering, Construction Engineering, and others. The application focus will attract some students in the door while a proportion of them are likely to continue on to the more traditional engineering degrees. Student migration from Robotics Engineering into traditional engineering disciplines has been one of the key considerations as we have crafted the curriculum and has led to a higher degree of flexibility than in nearly all of the current COE programs.

COE does already offer a number of courses in the Robotics Engineering topics and across departments; these will be incorporated into the new ROBO degree as electives and as one of the required courses. There currently are 226 students enrolled in 8 robotics-focused courses and 97 students enrolled in 6 robotics-focused courses that each have a laboratory component. Currently COE has a Robotics Minor which averages 20 students. The number of students who matriculate to completion of the minor is quite small (averaging 3 students per year). The challenge for these students appears to be similar for most ENGR students who have interest in a minor but find difficulty completing the requirements on top of their academic load in an engineering major. The proposed ROBO program provides an alternative where students can focus on robotics-oriented applications.

E. **Avoidance of Unnecessary Duplication**

There are no other robotics engineering degree programs in the state of Nebraska, and there are no other colleges of engineering in the state; thus, we are poised to rapidly and effectively establish a degree program in robotics engineering. Kansas offers a number of engineering technology degrees at Wichita State University and Kansas State University but no bachelors in robotics. South Dakota school of Mines and Technology offers a minor in robotics as does North Dakota State. Bismarck State offers an Associate's program in industrial automation and robotics. Iowa has a number of schools offering two-year technical degrees in robotics and automation but no four-year programs. Graduates from these programs could be recruited to continue their education at UNL. Colorado School of Mines offers emphasis tracks in robotics for their computer science or mechanical engineering degrees but not as a standalone major. The University of Colorado offers Master of Science and Doctor of Philosophy degrees through their robotics program. Minnesota offers Master's level degrees in Robotics through the Minnesota University's Minnesota Robotics Institute as well as a number of technical degrees from smaller schools. The closest undergraduate four-year robotics degrees we could identify are located in Indiana, Michigan, Oklahoma, and Arizona.

F. **Adequacy of Resources:**

1. Faculty/Staff

   Two new professors of practice positions have been hired as part of the Heartland Robotics Cluster grant administered by the department of commerce's Economic Development Administration. The current plan is for them to spend year 0 developing curriculum for the new courses while piloting ROBO 100 and ROBO 150 in the Fall and Spring.

2. Library/Information Resources

   Current library resources will be sufficient to support the program.

3. Physical Facilities and Equipment

   Classrooms will be identified in Kiewit Hall. A dedicated teaching laboratory has been identified in Scott Engineering Center, room C330.

4. Instructional Equipment and Informational Resources

   The current EDA funding provides resources to purchase teaching equipment for robotics and some operational support. Refresh of equipment will be maintained regularly and using College resources.

5. Course and Lab Fees

   We anticipate that ROBO students would pay differential tuition. Additionally we plan to include lab fees in ROBO 150, 302, and 350 to offset some materials costs.

6. Budget Projections [include Table 1 and Table 2]

IV. Appendix

A. **Catalog Copy**

B. **Four Year Plan Block Diagrams**

C. **Letters of Support**

Internal

Jerry Hudgins, Professor and Chair, Electrical and Computer Engineering
Witawas Srisa-an, Director, School of Computing
Jeffrey Shield, Professor and Chair, Mechanical and Materials Engineering

External

Daniel Hoffman, CEO, Invest Nebraska
Carrick Detwiler, CEO, Drone Amplified, INC and Professor, School of Computing

D. **Hanover Report**

Appendix A: Catalog Copy

Overview

A. **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 responsible use of robotic and automation technologies.

Program Educational Objectives

The primary student learning outcomes of the proposed degree program are described here. The educational program in robotics engineering is designed so that, within a few years of graduation, our Robotics Engineering graduates will:

1. Have established successful careers in robotics, automation, or related fields, demonstrating their ability to apply principles of robotics engineering to responsibly solve complex problems.
2. Engage in continuous learning and professional development to stay abreast of advancements in robotics and emerging technologies.
3. Demonstrate leadership, ethical conduct, and effective communication in multidisciplinary teams, contributing to the progress of the robotics profession and society.
4. Contribute to the advancement of robotics and automation through innovation, research, or entrepreneurial endeavors, showcasing the ability to push the boundaries of knowledge and technology in the field.

B. **Admission**

Students are expected to meet minimum college entrance requirements. After being admitted to the college, students wishing to pursue a degree in robotics engineering must go through the Professional Admission process, which is performed for qualifying students with GPA of at least 2.5 after completion of ROBO200 with minimum grade of C+.

C. **College 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 and Argument.

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.

D. **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.

E. **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 atthe previous institution. Students must complete all degree requirements from a single catalog year and within the timeframe allowable for that catalog year.

F. **Learning Outcomes**

The Student Learning Outcomes listed below will be assessed on a regular basis, pursuant to accreditation requirements through the Accreditation Board for Engineering and Technology (ABET). The assessment results will be reviewed regularly by our faculty to ensure that at the time of graduation, Robotics Engineering students 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.

G. **Quick Points**

1.	College	Engineering
2.	Degree Offered	Bachelor of Science in Robotics Engineering
3.	Hours Required	128
4.	Minimum Cumulative GPA	2.4 for graduation
5.	Minor Available	Yes

H. **Major Requirements**

Robotics Core

ROBO 100	Introduction to Robotics	3
ROBO 150	Robotics Tools	3
ECEN 345	Mobile Robotics	4
ROBO 299	Robotics Career Experiences	1
ROBO 302	Robot Design and Control	3
ROBO 303	Robot Software and Algorithms	3
ROBO 350	Robotic System Integration	3
ROBO 446	Capstone 1 (ACE 8)	3
ROBO 447	Capstone 2 (ACE 10)	3
Credit hours subtotal:		**26**

Engineering Seminars

ENGR 10	Freshman Engineering Seminar	0
ENGR 20	Sophomore Engineering Seminar	0
Credit hours subtotal		**0**

Mathematics

MATH 106	Calculus 1 (ACE 3)	5
MATH 107	Calculus 2 (ACE 3)	4
MATH 221	Differential Equations (ACE 3)	3
ECEN 305 / MECH 321	Statistics	3
ROBO 200	Robotics Analysis Core	3
Credit hours subtotal:		**18**

Science

PHYS 211	General Physics 1 (ACE 4)	4
PHYS 221	General Physics Lab 1	1
PHYS 212	General Physics 2 (ACE 4)	4
PHYS 222	General Physics Lab 2	1
ECEN 215	Electronics and Circuits 1	3
ECEN 235	Circuits lab 1	1
Credit hours subtotal:		**14**

Technical Writing (ACE 1)

JGEN 200	Technical Communication (ACE 1)	3
Or JGEN 120, JGEN 300, ENGL 151		
Credit hours subtotal		**3**

Communication (ACE 2)

ENGR 100	Interpersonal Skills (ACE 2)	3
Or COMM 286		
Credit hour subtotal		**3**

ACE Requirements

Select one course each from ACE 5, 6, 7, 9	12

Core Computer Science Requirements

CSCE 155E	Computer Science 1	3
CSCE156	Computer Science 2	4
CSCE 331	Data Structures	3
Credit hours subtotal:		**10**

Core Electrical Engineering Requirements

ECEN 216	Electronics and Circuits 2	3
ECEN 236	Circuits lab 2	1
ECEN 220 / CSCE 336	Embedded Systems	3
ECEN 304	Signals and Systems 1	3
Credit hours subtotal:		**10**

Core Mechanical Engineering Requirements

MECH 223	Statics	3
MECH 373	Engineering Dynamics	3
MECH 350	Dynamics and Control	3
Credit hours subtotal:		**9**

Technical electives

Take 23 elective credits from one of the following focus areas

Robot Design / Build focus area (recommended courses)

MECH 230	Intro to Mechanical Engineering Design	3
MECH 342	Kinematics	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	Control Systems	3
MECH 457	Mechatronic System Design	3
MECH 492	Special Topics	1-6
Advisor-approved 400 level MECH course		3

Robot Software / Algorithms focus area (recommended courses)

CSCE 230	Computer Organization	4
CSCE 351	Operating Systems Kernels	3

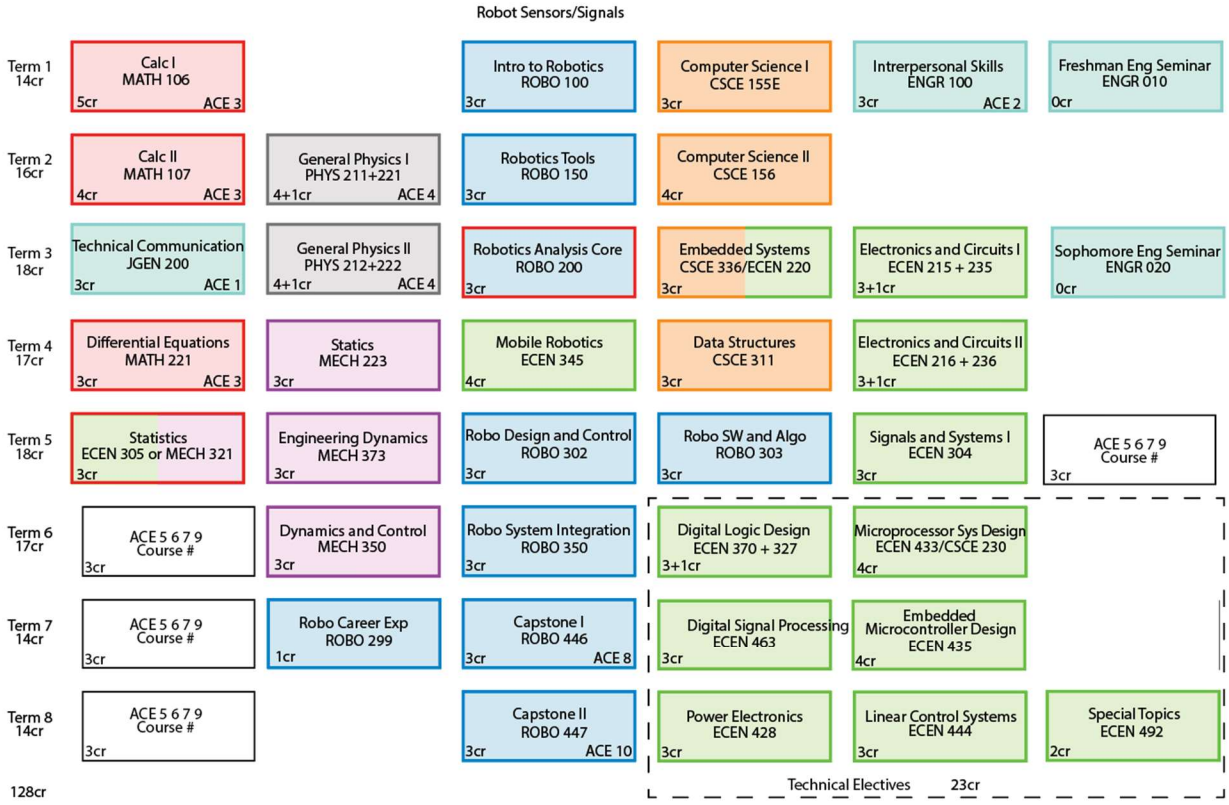
CSCE 361	Software Engineering	3
CSCE 436	Advanced Embedded Systems	3
CSCE 454	Human Robot Interaction	3
CSCE 460	Software Engineering for Robotics	3
CSCE 473	Computer Vision	3
CSCE 476	Intro to AI	3
CSCE 492	Special Topics	1-6
Advisor-approved 400 level CSCE course		3

Robot Sensors / Signals focus area (recommended courses)

ECEN370	Digital Logic Design	3
ECEN 327	Digital Logic Design lab	1
ECEN 433	Microprocessor System Design	4
ECEN 463	Digital Signal Processing	3
ECEN 435	Embedded Microcontroller Design	4
ECEN 428	Power Electronics	3
ECEN 444	Linear Control Systems	3
ECEN 464	Communication Systems	3
ECEN 492	Special Topics	1-6
Advisor-approved 400 level ECEN course		3

I. **Other** (formatting placeholder)

Appendix B: Four-Year Plan Block Diagrams



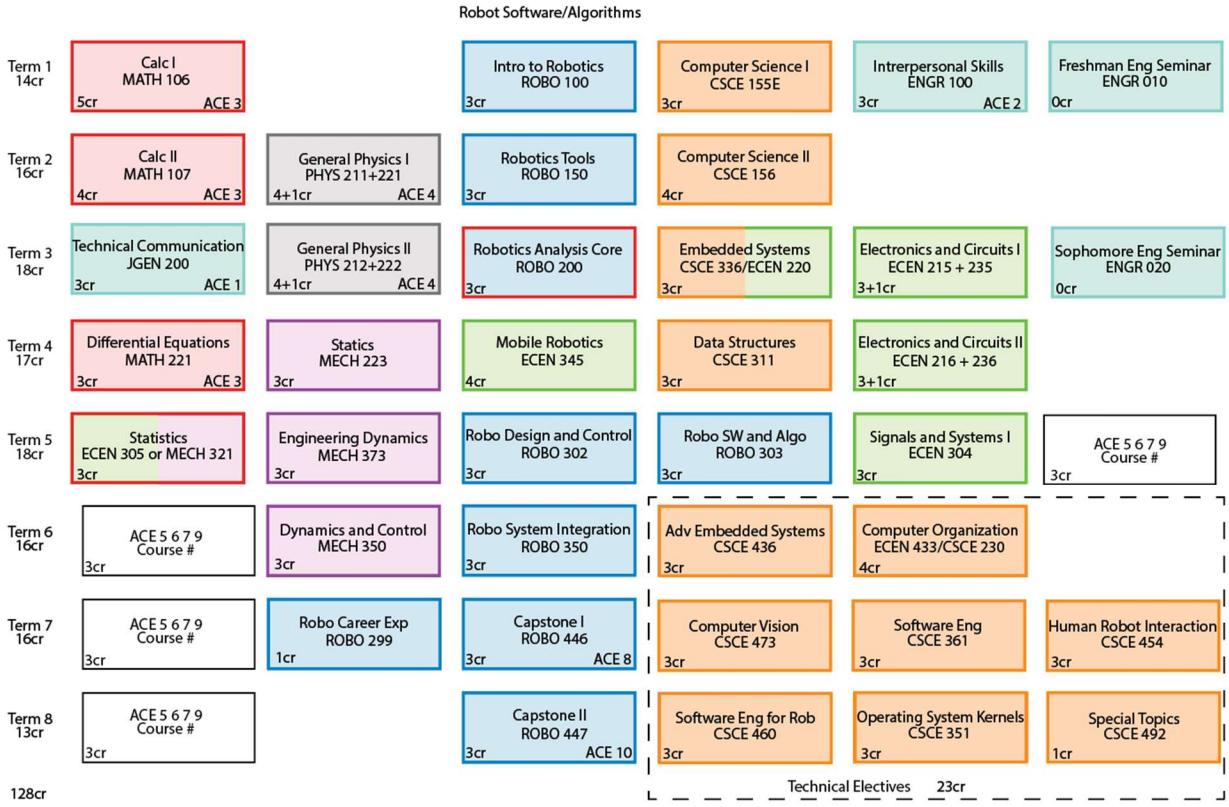


TABLE 2: REVENUE SOURCES FOR PROJECTED EXPENSES - NEW INSTRUCTIONAL PROGRAM

	FY2025-26 Year 1	FY2026-27 Year 2	FY2027-28 Year 3	FY2028-29 Year 4	FY2029-30 Year 5	**Total**
Reallocation of Existing Funds						$ -
Required New Public Funds						$ -
1. State Funds						$ -
2. Local Tax Funds (community colleges)						$ -
Tuition and Fees [1]	$ 373,295	$ 746,590	$ 1,119,885	$ 1,493,180	$ 1,866,475	$ 5,599,425
Other Funding						$ -
1 Heartland Robotics Cluster Grant	$ 309,192	$ 317,718				$ 626,910
2						$ -
3						$ -
Total Revenue	$ 682,487	$ 1,064,308	$ 1,119,885	$ 1,493,180	$ 1,866,475	$ 6,226,335

[1] Tuition only per projected enrollment and tuition rate schedule below.

CCPE; 11/19/08

	Year 1	Year 2	Year 3	Year 4	Year 5
Enrolled Students	25	50	75	100	125
Resident 85% @ Avg. Rate	$ 244,460	$ 488,920	$ 733,380	$ 977,840	$ 1,222,300
Non-resident 15% @ Avg. Rate	$ 128,835	$ 257,670	$ 386,505	$ 515,340	$ 644,175
Total Tuition	$ 373,295	$ 746,590	$ 1,119,885	$ 1,493,180	$ 1,866,475

Tuition Rates	Percentage	Rate / CH	CH/Year
Resident CoE courses	85%	$ 397	22
Non-resident CoE courses	15%	$ 1,158	22
Resident Base	85%	$ 277	10
Non-resident Base	15%	$ 888	10
Average Resident Combined Tuition		$ 359.50	$ 11,504
Average Non-resident Combined Tuition		$ 1,073.63	$ 34,356

TABLE 1: PROJECTED EXPENSES - NEW INSTRUCTIONAL PROGRAM

	FY2025-26 Year 1		FY2026-27 Year 2		FY2027-28 Year 3		FY2028-29 Year 4		FY2029-30 Year 5		**Total**	
Personnel	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	**FTE**	**Cost**
Faculty [1]	2.00	$ 284,192	2.00	$ 292,718	2.00	$ 301,499	2.00	$ 310,544	2.00	$ 319,861	2.00	$ 1,508,814
Professional											-	$ -
Graduate assistants											-	$ -
Support staff											-	$ -
Subtotal	2.00	$ 284,192	2.00	$ 292,718	2.00	$ 301,499	2.00	$ 310,544	2.00	$ 319,861	2.00	$ 1,508,814
Operating												
General Operating [2]	$ 25,000		$ 25,000		$ 25,000		$ 25,000		$ 25,000		$	125,000
Equipment											$	-
New or renovated space											$	-
Library/Information Resources											$	-
Other											$	-
Subtotal	$ 25,000		$ 25,000		$ 25,000		$ 25,000		$ 25,000		$	125,000
Total Expenses	2.00	$ 309,192	2.00	$ 317,718	2.00	$ 326,499	2.00	$ 335,544	2.00	$ 344,861	**2.00**	**$ 1,633,814**

[1] Estimated salaries and benefits for two full-time faculty of practice, assuming 3% annual increases.

[2] General operating expenses for faculty development, laboratory equipment and supplies, travel, memberships, office equipment and supplies, communications, data processing, equipment maintenance, rentals, etc.

CCPE; 11/19/08