MECHANIZED SYSTEMS MANAGEMENT

Description
Website: http://msym.unl.edu

The mechanized systems management (MSYM) major prepares students for delivery, management, and technical support of engineered systems for agriculture, food, energy, and water. Students will develop technical, systems analysis, and management skills. This major is ideal for students interested in working with machinery and equipment systems from a practical perspective. The MSYM program includes hands-on coursework in power and machinery systems, processing and handling equipment, and sensors and controls combined with coursework in business, management, agriculture, and natural sciences that prepares students for a wide range of careers in a variety of industries related to agriculture, food, energy, and water. The program offers four options for specialization:

- Production Option
- Business Option
- Technical Option
- Processing Operations Option

Students in the MSYM major benefit from small classes and personalized faculty advising. Students have the opportunity to work part-time in the Nebraska Tractor Test Laboratory and numerous departmental research projects. Students are encouraged to participate in student clubs such as the Mechanized Systems Management Club, the Tractor Restoration Club, and the University of Nebraska–Lincoln Quarter Scale Tractor Team.

College Requirements

College Admission

Requirements for admission into the College of Agricultural Sciences and Natural Resources (CASNR) are consistent with general University admission requirements (one unit equals one high school year): 4 units of English, 4 units of mathematics, 3 units of natural sciences, 3 units of social sciences, and 2 units of world language. Students must also meet performance requirements: a 3.0 cumulative high school grade point average OR an ACT composite of 20 or higher, writing portion not required OR a score of 1040 or higher on the SAT Critical Reading and Math sections OR rank in the top one-half of graduating class; transfer students must have a 2.0 (on a 4.0 scale) cumulative grade point average and 2.0 on the most recent term of attendance. For students entering the PGA Golf Management degree program, a certified golf handicap of 12 or better (e.g., USGA handicap card) or written ability (MS Word file) equivalent to a 12 or better handicap by a PGA professional or high school golf coach is required. For more information, please visit http://pgm.unl.edu/requirements/.

Admission Deficiencies/Removal of Deficiencies

Students who are admitted to CASNR with core course deficiencies must remove these deficiencies within the first 30 credit hours at the University of Nebraska–Lincoln, or within the first calendar year at Nebraska, whichever takes longer, excluding foreign languages. Students have up to 60 credit hours to remove world language deficiencies. College-level coursework taken to remove deficiencies may be used to meet degree requirements in CASNR.

Deficiencies in the required entrance subjects can be removed by the completion of specified courses in the University or by correspondence.

The Office of Admissions, Alexander Building (south entrance), City Campus, provides information to new students on how deficiencies can be removed.

College Degree Requirements

Curriculum Requirements

The curriculum requirements of the College consist of three areas: ACE (Achievement-Centered Education), College of Agricultural Sciences and Natural Resources Core, and Degree Program requirements and electives. All three areas of the College Curriculum Requirements are incorporated within the description of the Major/Degree Program sections of the catalog. The individual major/degree program listings of classes ensures that a student will meet the minimum curriculum requirements of the College.

World Languages/Language Requirement

Two units of a world language are required. This requirement is usually met with two years of high school language.

Minimum Hours Required for Graduation

The College grants the bachelors degree in programs associated with agricultural sciences, natural resources, and related programs. Students working toward a degree must earn at least 120 semester hours of credit. A minimum cumulative grade point average of C (2.0 on a 4.0 scale) must be maintained throughout the course of studies and is required for graduation. Some degree programs have a higher cumulative grade point average required for graduation. Please check the degree program on its graduation cumulative grade point average.

Grade Rules

Removal of C-, D, and F Grades

Only the most recent letter grade received in a given course will be used in computing a student's cumulative grade point average if the student has completed the course more than once and previously received a grade or grades below C in that course.

The previous grade (or grades) will not be used in the computation of the cumulative grade point average, but it will remain a part of the academic record and will appear on any transcript.

A student can remove from his/her cumulative average a course grade of C, D+, D, D-, or F if the student repeats the same course at the University of Nebraska and receives a grade other than P (pass), I (incomplete), N (no pass), W (withdrew), or NR (no report). If a course is no longer being offered, it is not eligible for the revised grade point average computation process.

For complete procedures and regulations, see the Office of the University Registrar website at http://www.unl.edu/regrec/course-repeats (http://www.unl.edu/regrec/course-repeats/).

Pass/No Pass

Students in CASNR may take any course offered on a Pass/No Pass basis within the 24-hour limitation established by the Faculty Senate. However, a department may specify that the Pass/No Pass status of its courses be limited to non-majors or may choose to offer some courses for letter grades only.
GPA Requirements
A minimum cumulative grade point average of C (2.0 on a 4.0 scale) must be maintained throughout the course of studies and is required for graduation. Some degree programs have a higher cumulative grade point average required for graduation. Please check the degree program on its graduation cumulative grade point average.

Transfer Credit Rules
To be considered for admission, a transfer student, Nebraska resident or nonresident, must have an accumulated average of C (2.0 on a 4.0 scale) and a minimum C average in the last semester of attendance at another college. Transfer students who have completed less than 12 credit hours of college study must submit either ACT or SAT scores.

Ordinarily, credits earned at an accredited college are accepted by the University. The College, however, will evaluate all hours submitted on an application for transfer and reserves the right to accept or reject any of them. Sixty (60) is the maximum number of hours the University will accept on transfer from a two-year college. Ninety (90) is the maximum number of hours the University will accept from a four-year college. Transfer credit in the degree program must be approved by the degree program advisor on a Request for Substitution Form to meet specific course requirements, group requirements, or course level requirements in the major. At least 9 hours in the major field, including the capstone course, must be completed at the University of Nebraska–Lincoln regardless of the number of hours transferred.

The College will accept no more than 10 semester hours of C, D+, D, and D- grades from other schools. The C, D+, D, and D- grades can only be applied to free electives. This policy does not apply to the transfer of grades from UNO or UNK to the University of Nebraska–Lincoln.

Joint Academic Transfer Programs
The College of Agricultural Sciences and Natural Resources has agreements with many institutions to support joint academic programs. The transfer programs include dual degree programs and cooperative degree programs. Dual degree programs offer students the opportunity to receive a degree from a participating institution and also to complete requirements for a bachelor of science degree in CASNR. Cooperative programs result in a single degree from either the University of Nebraska–Lincoln or the cooperating institution.

Dual Degree Programs
A to B Programs
The A to B Program, a joint academic program offered by the CASNR and participating community colleges, allows students to complete the first two years of a degree program at the participating community college and continue their education and study in a degree program leading toward a bachelor of science degree.

The A to B Program provides a basic knowledge plus specialized coursework. Students transfer into CASNR with junior standing.

Depending on the community college, students enrolled in the A to B Program may complete the requirements for an associate of science at the community college, transfer to the University of Nebraska–Lincoln, and work toward a bachelor of science degree.

Participating community colleges include:

- Central Community College
- Metropolitan Community College
- Mid-Plains Community College

- Nebraska College of Technical Agriculture
- Nebraska Indian Community College
- Northeast Community College
- Southeast Community College
- Western Nebraska Community College

3+2 Programs
Two specialized degree programs in animal science and veterinary science are offered jointly with an accredited college or school of veterinary medicine. These two programs permit CASNR animal science or veterinary science students to receive a bachelor of science degree from the University of Nebraska–Lincoln with a degree in animal science or veterinary science after successfully completing two years of the professional curriculum in veterinary medicine at an accredited veterinary school. Students who successfully complete the 3+2 Program, must provide transcripts and complete the Application for Degree form via MyRED. Students without MyRED access may apply for graduation in person at Husker Hub in the Canfield Administration Building, or by mail. Students should discuss these degree programs with their academic advisor.

Cooperative Degree Programs
Academic credit from the University and a cooperating institution are applied towards a four-year degree from either the University of Nebraska–Lincoln (University degree-granting program) or the cooperating institution (non University degree-granting program). All have approved programs of study.

UNL Degree-Granting Programs
A University of Nebraska–Lincoln degree-granting program is designed to provide students the opportunity to complete a two-year program of study at one of the four-year institutions listed below, transfer to CASNR, and complete the requirements for a bachelor of science degree.

Chadron State College. Chadron State College offers a 2+2 program leading to a grassland ecology and management degree program and a transfer program leading to a bachelor of science in agricultural education in the teaching option.

Wayne State College. Wayne State College offers a 3+1 program leading to a bachelor of science in plant biology in the ecology and management option and a 3+1 program leading to a bachelor of science in Applied Science.

University of Nebraska at Kearney. Transfer programs are available for students pursuing degree programs leading to a bachelor of science degree.

University of Nebraska at Omaha. Transfer programs are available for students pursuing degree programs leading to a bachelor of science degree.

Non University of Nebraska–Lincoln Degree-Granting Programs
CASNR cooperates with other institutions to provide coursework that is applied towards a degree at the cooperating institution. Pre-professional programs offered by CASNR allow students to complete the first two or three years of a degree program at the University prior to transferring and completing a degree at the cooperating institution.

Chadron State College—Range Science. The 3+1 Program in range science allows Chadron State College students to pursue a range science degree through Chadron State College. Students complete three years of
coursework at Chadron State College and one year of specialized range science coursework (32 credit hours) at CASNR.

Dordt College (Iowa)—Agricultural Education: Teaching Option. This program allows students to pursue an Agricultural Education Teaching Option degree leading toward a bachelor of science in agricultural education. Students at Dordt College will complete 90 credit hours in the Agricultural Education: Teaching Option Transfer Program.

Residency
Students must complete at least 30 of the total hours for their degree using University of Nebraska–Lincoln credits. At least 18 of the 30 credit hours must be in courses offered through CASNR\(^1\) (>299) including the appropriate ACE 10 degree requirement or an approved ACE 10 substitution offered through another Nebraska college and excluding independent study regardless of the number of hours transferred. Credit earned during education abroad may be used toward the residency requirement if students register through the University of Nebraska–Lincoln and participate in prior-approved education abroad programs. University of Nebraska–Lincoln open enrollment and summer independent study courses count toward residence.

Credit earned online may count toward residency. However, certain offerings may not be counted toward scholarship requirements or academic recognition criteria.

For further information, contact:
Office of Online and Distance Education
University of Nebraska–Lincoln
305 Brace Labs
Lincoln, NE 68588-0109
402-472-4681
http://online.unl.edu/

Independent Study Rules
Students wishing to take part in independent studies must obtain permission; complete and sign a contract form; and furnish copies of the contract to the instructor, advisor, departmental office, and the Dean’s Office. The contract should be completed before registration. Forms are available in 103 Agricultural Hall or online at the CASNR website.

Independent study projects include research, literature review or extension of coursework under supervision and evaluation of a departmental faculty member.

Students may only count 12 hours of independent study toward their degrees and no more than 6 hours can be counted during their last 36 hours earned, excluding senior thesis, internships, and courses taught under an independent study number.

Other College Degree Requirements

Capstone Course Requirement
A capstone course is required for each CASNR degree program. A capstone course is defined as a course in which students are required to integrate diverse bodies of knowledge to solve a problem or formulate a policy of societal importance.

ACE Requirements
All students must fulfill the Achievement Centered Education (ACE) requirements. Information about the ACE program may be viewed at ace.unl.edu (https://ace.unl.edu/).

The minimum requirements of CASNR reflect the common core of courses that apply to students pursuing degrees in the college. Students should work with an advisor to satisfy ACE outcomes 1, 2, 3, 4, 6, and 10 with the college requirements.

Catalog Rule
Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to the University of Nebraska–Lincoln or when they were first admitted to a Joint Academic Transfer Program. 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 Agricultural Sciences and Natural Resources. 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.

Learning Outcomes
Graduates of mechanized systems management will be able to:

1. Apply hands-on technical skills and knowledge from the natural and social sciences, technology, engineering, and mathematics to analyze and manage mechanized systems relevant to agriculture, food, energy, and water.
2. Identify the structure, layout, and function of mechanized systems, including the relationships between individual components of a system.
3. Evaluate a system critically by defining a problem, assimilating information, conducting an analysis, and making technical and economic recommendations to improve performance of the system while accounting for potential social and environmental impacts.
4. Develop professional written and oral reports to describe a mechanized system and communicate an analysis of the system that includes objectives, methods, results, and recommendations.

Major Requirements

Core Requirements

Integrative Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCIL 101</td>
<td>Science and Decision-Making for a Complex World</td>
<td>3</td>
</tr>
<tr>
<td>MSYM 462</td>
<td>Equipment Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 6

Mathematics and Statistics (ACE 3)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 102</td>
<td>Trigonometry</td>
<td>2</td>
</tr>
<tr>
<td>STAT 218</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 5

Communications

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSEN 130</td>
<td>Computer-Aided Design</td>
<td>2</td>
</tr>
</tbody>
</table>
Select one Written Communication elective (ACE 1) of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 150</td>
<td>Writing and Inquiry</td>
</tr>
<tr>
<td>ENGL 151</td>
<td>Writing and Argument</td>
</tr>
<tr>
<td>JGEN 200</td>
<td>Technical Communication I</td>
</tr>
</tbody>
</table>

Select one Professional Communication elective (ACE 2) of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM 209</td>
<td>Public Speaking</td>
</tr>
<tr>
<td>COMM 210</td>
<td>Communicating in Small Groups</td>
</tr>
<tr>
<td>COMM 286</td>
<td>Business and Professional Communication</td>
</tr>
<tr>
<td>JGEN 300</td>
<td>Technical Communication II</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 8

**Natural Sciences**

<table>
<thead>
<tr>
<th>Course Code &amp; Lab</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 109A &amp; CHEM 109L</td>
<td>General Chemistry I and General Chemistry I Laboratory (ACE 4)</td>
</tr>
<tr>
<td>MSYM 109 &amp; MSYM 109L</td>
<td>Physical Principles in Agriculture and Life Sciences Laboratory (ACE 4)</td>
</tr>
</tbody>
</table>

Select one CASNR approved Life Sciences elective (ACE 4) of the following:

<table>
<thead>
<tr>
<th>Course Code &amp; Lab</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRO 131 &amp; HORT 131 &amp; AGRO 132</td>
<td>Plant Science and Agronomic Plant Science Laboratory</td>
</tr>
<tr>
<td>BIOS 101 &amp; BIOS 101L</td>
<td>General Biology and General Biology Laboratory</td>
</tr>
<tr>
<td>LIFE 120 &amp; LIFE 120L</td>
<td>Fundamentals of Biology I and Fundamentals of Biology I laboratory</td>
</tr>
</tbody>
</table>

Select 7 hours of Natural Sciences electives from the following:

- Biochemistry
- Biology
- Chemistry
- Geography (excluding human and economic)
- Geology
- Life Sciences (excluding 115)
- Meteorology (excluding 140)
- Physics and Astronomy (excluding 103)

Credit Hours Subtotal: 7

**Economics, Humanities and Social Sciences**

<table>
<thead>
<tr>
<th>Course Code &amp; Lab</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSEN 206 / CONE 206</td>
<td>Engineering Economics (ACE 8)</td>
</tr>
<tr>
<td>ECON 211</td>
<td>Principles of Macroeconomics</td>
</tr>
<tr>
<td>ECON 212</td>
<td>Principles of Microeconomics</td>
</tr>
<tr>
<td>or AECD 141</td>
<td>Introduction to the Economics of Agriculture</td>
</tr>
</tbody>
</table>

Select one course each from ACE outcomes 5, 7, and 9

Credit Hours Subtotal: 18

**Major Requirements**

Complete requirements

Credit Hours Subtotal: 21

**Option Requirements**

Complete requirements

Credit Hours Subtotal: 33

**Personal Development Electives**

Select 9 hours

Credit Hours Subtotal: 9

Total Credit Hours: 120

**Specific Major Requirements**

**Major Requirements**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSYM 162</td>
<td>Introduction to Mechanized Systems Management</td>
</tr>
<tr>
<td>MSYM 232</td>
<td>Power and Machinery Principles</td>
</tr>
<tr>
<td>MSYM 245</td>
<td>Fundamentals of Electrical Systems</td>
</tr>
<tr>
<td>MSYM 262</td>
<td>Problem Solving in Mechanized Systems Management</td>
</tr>
<tr>
<td>MSYM 354 / SOIL 354 / WATS 354</td>
<td>Soil Conservation and Watershed Management</td>
</tr>
<tr>
<td>MSYM 364</td>
<td>Agricultural Products Processing and Handling</td>
</tr>
<tr>
<td>MSYM 416</td>
<td>Sensors and Control Systems for Agriculture Industries</td>
</tr>
<tr>
<td>SOIL 153 / AGRO 153 / HORT 153</td>
<td>Soil Resources</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 21

Total Credit Hours: 21

1. In addition to capstone MSYM 462.

**Production Option**

The production option is for students interested in careers in production agriculture such as farming, ranching, and crop consulting. The option integrates coursework in mechanized systems management with agricultural sciences, management, and marketing. Students have flexibility in course selection to pursue minors in areas such as agronomy and animal science.

**Option Requirements**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRO 204</td>
<td>Resource-Efficient Crop Management</td>
</tr>
<tr>
<td>AECD 201</td>
<td>Farm and Ranch Management</td>
</tr>
<tr>
<td>AECD 235 / MRKT 235</td>
<td>Introduction to Commodity Marketing</td>
</tr>
<tr>
<td>ASCI 250</td>
<td>Animal Management</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 8

**Mechanized Systems Management Electives**

Select three of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSYM 342</td>
<td>Animal Housing Systems</td>
</tr>
<tr>
<td>MSYM 412</td>
<td>Hydraulic Power Systems</td>
</tr>
<tr>
<td>MSYM 431 / AGRO 431</td>
<td>Site-specific Crop Management</td>
</tr>
<tr>
<td>MSYM 433</td>
<td>Equipment and Tractor Testing</td>
</tr>
<tr>
<td>MSYM 452 / AGRO 452 / WATS 452</td>
<td>Irrigation Systems Management</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 9

**Production Agriculture Electives**

Select 8-11 hours from specified CASNR courses at 200 level or above

Credit Hours Subtotal: 8-11

**Option Electives**

Select 0-3 hours

Credit Hours Subtotal: 0-3
**Mechanized Systems Management**

<table>
<thead>
<tr>
<th>MSYM 395</th>
<th>Internship in Mechanized Systems Management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Business or agricultural economics course</td>
</tr>
<tr>
<td>Credit Hours Subtotal:</td>
<td>33-36</td>
</tr>
<tr>
<td>Total Credit Hours</td>
<td>33-36</td>
</tr>
</tbody>
</table>

1 Refer to degree audit or contact advisor for list of classes.

### Business Option

The business option is for students interested in business-related careers such as marketing, sales, and management in agriculture and related industries. This option integrates coursework in mechanized systems management with additional business courses. Students can easily pursue a business minor with this option.

#### Option Requirements

| ACCT 200 | Accounting for Business Decisions | 3 |
| AGRO 204 | Resource-Efficient Crop Management | 3 |
| or ASCI 250 | Animal Management | |
| MATH 104 | Applied Calculus | 3 |

#### Mechanized Systems Management Electives

Select 9 hours from the following:

| MSYM 342 | Animal Housing Systems |
| MSYM 395 | Internship in Mechanized Systems Management |
| MSYM 400E | Biorenewable Systems Technology |
| MSYM 400J | Machinery Management Using Precision Agriculture Technology |
| MSYM 412 | Hydraulic Power Systems |
| MSYM 431 / AGEN 431 / AGRO 431 | Site-specific Crop Management |
| MSYM 452 / AGRO 452 / WATS 452 | Irrigation Systems Management |

#### Business Law Elective

Select one of the following: 3

| AECN 256 | Legal Aspects in Agriculture |
| AECN 357 / NREE 357 | Natural Resource and Environmental Law |
| BLAW 300 | Business, Government & Society |

#### Finance Elective

| AECN 452 | Agricultural Finance | 3 |
| or FINA 300 | Financial Decision Making | |

#### Marketing Elective

Select one of the following: 3

| AECN 225 / EAE 225 / MRKT 225 | Agribusiness Entrepreneurship in Food Products Marketing |
| AECN 235 / MRKT 235 | Introduction to Commodity Marketing |
| MRKT 300 | Contemporary Marketing |

#### Management Electives

Select two of the following: 6-7

| AECN 201 | Farm and Ranch Management |
| AECN 316 | Agribusiness Management |

### Technical Option

The technical option is for students interested in hands-on technical careers such as test engineers, product support specialists, and service managers. This option integrates coursework in mechanized systems management with additional coursework in engineering. This option will also prepare students for graduate study.

#### Option Requirements

| MATH 106 | Calculus I | 5 |
| MSYM 395 | Internship in Mechanized Systems Management | 1-3 |
| or MSYM 400A | Occupational Safety | |
| MSYM 412 | Hydraulic Power Systems | 3 |
| MSYM 433 | Equipment and Tractor Testing | 3 |

Select one of the following: 3

| AGRO 204 | Resource-Efficient Crop Management |
| ASCI 250 | Animal Management |
| ASCI 210 | Animal Products |

#### Management Electives

Select two of the following: 6

| AECN 316 | Agribusiness Management |
| MNGT 300 | Management Essentials For Contemporary Organizations |
| MNGT 361 | Human Resource Management |

#### Option Electives

Select four of the following: 12

| ENSC 220 | Introduction to Energy Systems |
| CNST 305 / ARCH 333 | Building Environmental Technical Systems |
| MSYM 342 | Animal Housing Systems |
| MSYM 431 / AGEN 431 / AGRO 431 | Site-specific Crop Management |
| MSYM 400E | Biorenewable Systems Technology |
| MSYM 400J | Machinery Management Using Precision Agriculture Technology |
| MSYM 436 | Embedded Controls for Agricultural Applications |
| MSYM 452 / AGRO 452 / WATS 452 | Irrigation Systems Management |

Credit Hours Subtotal: 33-35

Total Credit Hours 33-35

### Processing Operations Option

The processing operations option is for students interested in careers in operations management for food, feed, and fuel companies. This option integrates coursework in mechanized systems management, with
business, agricultural sciences, and food sciences. This option will also prepare students for graduate study.

**Option Requirements**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRO 437</td>
<td>Animal, Food and Industrial Uses of Grain</td>
<td>2</td>
</tr>
<tr>
<td>AECN 235 /</td>
<td>Introduction to Commodity Marketing</td>
<td>3</td>
</tr>
<tr>
<td>MRKT 235</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ASCI 210</td>
<td>Animal Products</td>
<td>3</td>
</tr>
<tr>
<td>MATH 104</td>
<td>Applied Calculus</td>
<td>3-5</td>
</tr>
<tr>
<td>or MATH 106</td>
<td>Calculus I</td>
<td></td>
</tr>
<tr>
<td>MSYM 395</td>
<td>Internship in Mechanized Systems Management</td>
<td>1-3</td>
</tr>
<tr>
<td>or MSYM 400A</td>
<td>Occupational Safety</td>
<td></td>
</tr>
<tr>
<td>MNGT 300</td>
<td>Management Essentials For Contemporary Organizations</td>
<td>3</td>
</tr>
<tr>
<td>or AECN 316</td>
<td>Agribusiness Management</td>
<td></td>
</tr>
<tr>
<td>MSYM 363 /</td>
<td>Heat and Mass Transfer</td>
<td>3</td>
</tr>
<tr>
<td>FDST 363</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>MSYM 412</td>
<td>Hydraulic Power Systems</td>
<td>3</td>
</tr>
<tr>
<td>MSYM 465 /</td>
<td>Food Engineering Unit Operations</td>
<td>3</td>
</tr>
<tr>
<td>FDST 465</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Processing Electives**

Select 7-9 hours from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRO 438</td>
<td>Producing Grain for Animal, Food and Industrial Uses</td>
<td></td>
</tr>
<tr>
<td>ASCI 410</td>
<td>Processed Meats</td>
<td></td>
</tr>
<tr>
<td>ENSC 220</td>
<td>Introduction to Energy Systems</td>
<td></td>
</tr>
<tr>
<td>FDST 205</td>
<td>Food Composition and Analysis</td>
<td></td>
</tr>
<tr>
<td>FDST 403</td>
<td>Food Quality Assurance</td>
<td></td>
</tr>
<tr>
<td>FDST 412</td>
<td>Cereal Technology</td>
<td></td>
</tr>
<tr>
<td>FDST 413</td>
<td>Baking Technology</td>
<td></td>
</tr>
<tr>
<td>FDST 414</td>
<td>Egg Processing from Science to Technology</td>
<td></td>
</tr>
<tr>
<td>FDST 420</td>
<td>Fruit and Vegetable Technology</td>
<td></td>
</tr>
<tr>
<td>FDST 429</td>
<td>Dairy Products Technology</td>
<td></td>
</tr>
</tbody>
</table>

**Credit Hours Subtotal:** 33-37

**Total Credit Hours** 33-37

**Electives**

Students can select 9 credit hours of personal development electives. These electives can be used to foster a greater understanding of a topic of interest, to develop an inherent skill, or to pursue a minor.

**Requirements for Minor Offered by Department**

**Mechanized Systems Management Minor – 18 Hours**

The overall goal of the MSYM minor is to provide a foundation of technical knowledge to manage equipment systems relevant to food, agriculture, and natural resources. Students completing the minor will be able to apply hands-on technical skills and knowledge from the natural and social sciences, technology, engineering, and mathematics to analyze and manage mechanized systems relevant to agriculture, food, energy, and water.

**Required Courses for the minor**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSYM 232</td>
<td>Power and Machinery Principles</td>
<td>3</td>
</tr>
<tr>
<td>MSYM 232</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSYM 245</td>
<td>Fundamentals of Electrical Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

**Credit Hours Subtotal:** 6

**Technical Electives**

Select 6 hours from the following:

- MSYM 412 Hydraulic Power Systems
- MSYM 416 Sensors and Control Systems for Agri-Industries
- MSYM 433 Equipment and Tractor Testing
- MSYM 436 / AGEN 436 Embedded Controls for Agricultural Applications

**Credit Hours Subtotal:** 6

**Agricultural Systems Electives**

Select 6 hours from the following:

- MSYM 342 Animal Housing Systems
- MSYM 354 / SOIL 354 / WATS 354 Soil Conservation and Watershed Management
- MSYM 364 Agricultural Products Processing and Handling
- MSYM 431 / AGEN 431 / AGRO 431 Site-specific Crop Management
- MSYM 452 / WATS 452 Irrigation Systems Management

**Credit Hours Subtotal:** 6

**Total Credit Hours** 18

**MSYM 109 Physical Principles in Agriculture and Life Sciences**

**Prerequisites:** MATH 101 or 102 or 103 or 104 or 106; or placement in MATH 102 or 104 or 106.

**Notes:** Students cannot receive credit for both MSYM 109 and PHYS 141 or 151.

**Description:** Fundamental principles of mechanics, heat, electricity, magnetism and electromagnetism and their relationship to energy utilization and conservation. Principles then applied to problem situations in agriculture and life sciences.

**Credit Hours:** 4

**Max credits per semester:** 4

**Max credits per degree:** 4

**Grading Option:** Graded with Option

**Prerequisite for:** FDST 363, MSYM 363; MSYM 109L; MSYM 232; MSYM 245; MSYM 262; MSYM 342; MSYM 354, SOIL 354, WATS 354; MSYM 364; MSYM 452, MSYM 852, WATS 452, AGRO 452

**ACE:** ACE 4 Science

**MSYM 109L Physical Principles in Agriculture and Life Sciences Laboratory**

**Prerequisites:** MSYM 109 or parallel, or PHYS 151

**Description:** Laboratory experiments on mechanics, heat, electricity, magnetism and electromagnetism and their relationship to energy utilization and conservation in agriculture and life sciences.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option
MSYM 162 Introduction to Mechanized Systems Management

**Description:** Basic principles of describing and evaluating mechanized systems relevant to agriculture, food, energy, and water. Problem solving using systems-thinking. Exploration of major and career opportunities. Academic success and planning.

**Credit Hours:** 1
**Max credits per semester:** 1
**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Prerequisites:**
- MSYM 109, or PHYS 141, or PHYS 151, or PHYS 211, or parallel PHYS 211

**Offered:** FALL

**MSYM 245 Fundamentals of Electrical Systems**

**Prerequisites:** MSYM 109 or PHYS 141, or PHYS 151, or PHYS 211

**Description:** Basic theory of electrical circuits, utilization of electric energy in production, processing, and residential applications. Theory and application of direct current (DC) and alternating current (AC) principles, switch and outlet wiring, wiring installations, selection of safe and adequate circuit devices, service equipment sizing, conductor sizing, electric motor operation and their control are covered. Develop switch and relay circuit schematics and build both DC and AC functional circuits. Ladder logic diagrams will be studied to understand the basic controls implemented in industrial automation.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** SPRING

**Prerequisite for:** MSYM 412; MSYM 416

**MSYM 262 Problem Solving in Mechanized Systems Management**

**Prerequisites:** MSYM 109 or PHYS 141 or PHYS 151 or PHYS 211.

**Notes:** Open to MSYM majors only.

**Description:** Use of computational tools to solve problems relevant to mechanized systems management. Professional communication of technical information. Discussion of current and emerging issues relevant to the major.

**Credit Hours:** 1
**Max credits per semester:** 1
**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Offered:** SPRING

**MSYM 299 Career Experiences**

**Prerequisites:** Permission and advanced approval of plan or work.

**Description:** Student participation in physical systems applications. May include participation in mechanization-related areas of agribusiness, production practices, and processing operations; research in laboratory, greenhouse and field; or preparation of teaching materials.

**Credit Hours:** 1-5
**Min credits per semester:** 1
**Max credits per semester:** 5
**Max credits per degree:** 12

**Grading Option:** Pass No Pass

**Offered:** FALL

**MSYM 342 Animal Housing Systems**

**Prerequisites:** MSYM 109 or PHYS 141 or PHYS 151 or PHYS 211

**Description:** Production facilities for livestock and poultry will be developed with emphasis on building and feedlot layout, ventilation, heating and cooling systems; energy utilization; and construction materials and methods.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL

**MSYM 354 Soil Conservation and Watershed Management**

**Crosslisted with:** SOIL 354, WATS 354

**Prerequisites:** AGRO/SOIL 153; and MSYM 109 or PHYS 141 or PHYS 151 or PHYS 211

**Description:** Watershed hydrology, soil erosion, erosion control, water management, and land surveying and mapping. Includes rainfall-runoff relationships; determination of watershed characteristics; terraces, waterways, vegetative filters, and residue management; ponds, wetlands, non-point source pollution control, and water conservation; profile and topographic surveying.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL

**MSYM 363 Heat and Mass Transfer**

**Crosslisted with:** FDST 363

**Prerequisites:** MATH 104 or 106; MSYM 109 or PHYS 141 or 151.

**Description:** Fundamentals of food engineering including material and energy balances, fluid mechanics, heat transfer and mass transfer.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL

**MSYM 364 Agricultural Products Processing and Handling**

**Prerequisites:** MSYM 109 or PHYS 141 or PHYS 151 or PHYS 211

**Description:** Analysis of processing and handling operations. Chemical and physical characteristics of agricultural products. Application of pychrometrics. Power requirements, capacities, and efficiencies of drying and conveying systems. Discussion of safety issues, logistics, and survey of industry technologies.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** SPRING
MSYM 395 Internship in Mechanized Systems Management  
**Prerequisites:** Junior standing.  
**Notes:** Completion of internship proposal form is required. The internship proposal is subject to approval by the Department of Biological Systems Engineering. Pass/No Pass only.  
**Description:** Practical experience, directed learning, and career exploration and development in a selected business, industry, agency, or educational institution.  
**Credit Hours:** 1-3  
**Min credits per semester:** 1  
**Max credits per semester:** 3  
**Max credits per degree:** 5  
**Grading Option:** Pass No Pass

MSYM 400A Occupational Safety  
**Prerequisites:** Junior standing  
**Notes:** Online course offered by Iowa State University through the AG*IDEA consortium. Contact CASNR Distance Education Consortium Coordinator for course details, prerequisites and registration information.  
**Description:** Identifies safety and health risks in industrial work environments. Focus on how managers and supervisors meet their responsibilities for providing a safe workplace for their employees. Includes the identification and remediation of workplace hazards.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded

MSYM 400B Agricultural Safety and Health  
**Prerequisites:** Junior standing  
**Notes:** Online course offered by Iowa State University through the AG*IDEA consortium. Contact CASNR Distance Education Consortium Coordinator for course details, prerequisites and registration information.  
**Description:** Safety concepts, principles, practices, rules and regulations as they relate to agriculture will be explored. Developing and conducting safety programs, and conducting safety inspections and accident investigations are other aspects of the course.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded

MSYM 400E Biorenewable Systems Technology  
**Prerequisites:** Junior standing  
**Notes:** Online course offered by Iowa State University through the AG*IDEA consortium. Contact CASNR Distance Education Consortium Coordinator for course details, prerequisites and registration information.  
**Description:** The science, engineering, economics and business of converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, economics, transportation and logistics, and marketing.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded

MSYM 400J Machinery Management Using Precision Agriculture Technology  
**Prerequisites:** Junior standing  
**Notes:** Online course offered by University of Missouri through the AG*IDEA consortium. Contact CASNR Distance Education Consortium Coordinator for course details, prerequisites and registration information.  
**Description:** Management of agricultural equipment that is commonly used in conjunction with GPS technology such as planters, combines, fertilizer application equipment, and sprayer application equipment.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded

MSYM 400K Chemical Application Systems  
**Prerequisites:** Junior standing  
**Notes:** Online course offered by Kansas State University through the AG*IDEA consortium. Contact CASNR Distance Education Consortium Coordinator for course details, prerequisites and registration information.  
**Description:** Systems, components, operation practices, and safety procedures used in the chemical application industry. Liquid and granular application systems and respective components will be studied along with procedures for equipment sizing and maintenance, minimizing drift, system calibration, and safe handling-transportation-storage-disposal and spill clean-up of agrichemicals.  
**Credit Hours:** 2  
**Max credits per semester:** 2  
**Max credits per degree:** 2  
**Grading Option:** Graded

MSYM 412 Hydraulic Power Systems  
**Prerequisites:** MSYM 245  
**Description:** Theory and application of fluids under controlled pressure to perform work in mobile and industrial applications. Positive displacement (PD) pumps, linear and rotary hydraulic actuators (hydraulic cylinders and motors), valves, and electric over hydraulic systems will be studied in detail. Fluid power circuit development on both hydraulic benches and computer simulated environments will be performed with emphasis on circuit analysis, and system troubleshooting.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Grading Option:** Graded

MSYM 416 Sensors and Control Systems for Agri-Industries  
**Prerequisites:** MSYM 245 or permission.  
**Offered:** SPRING  
**Description:** Application of sensors for measurement of process control variables and implementation of microcomputer-based measurement and control systems. Basic electrical and electronic instrumentation plus control of electrically, pneumatically and/or hydraulically powered systems.  
**Credit Hours:** 2  
**Max credits per semester:** 2  
**Max credits per degree:** 2  
**Grading Option:** Graded with Option
MSYM 431 Site-specific Crop Management
Crosslisted with: AGEN 431, AGRO 431
Prerequisites: Senior standing; AGRO/SOIL 153; AGRO 204.
Description: Principles and concepts of site-specific management. Evaluation of geographic information systems for crop production practices. Practical experience with hardware and software necessary for successful application of information affecting crop management.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

MSYM 433 Equipment and Tractor Testing
Crosslisted with: MSYM 833
Prerequisites: MSYM 232; and STAT 218 or STAT 380 or MECH 321
Notes: Offered spring semester in even-numbered calendar years.
Description: Principles and procedures involved in testing agricultural equipment and tractors. Actual test planned, scheduled, conducted and reported. Test may be based upon procedures used at the Nebraska Tractor Testing Laboratory or involve other equipment being used for research in the department.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: SPRING

MSYM 436 Embedded Controls for Agricultural Applications
Crosslisted with: AGEN 436, AGEN 836, MSYM 836
Prerequisites: AGEN/BSEN 260 or MSYM 416
Description: Introduction to the basics of embedded controller programming, and the development of Controller Area Network (CAN) bus systems in agricultural applications. Interfacing sensors with analog and digital signals, closed loop control of actuators, transmission and reception of CAN messages, programming of CAN messages in a distributed controller set up for sensor data acquisition, and actuator control will be studied.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: FALL

MSYM 452 Irrigation Systems Management
Crosslisted with: MSYM 852, WATS 452, AGRO 452
Prerequisites: MSYM 109 or PHYS 141 or PHYS 151 or PHYS 211
Notes: AGRO/SOIL 153 recommended.
Description: Irrigation management and the selection, evaluation, and improvement of irrigation systems. Includes soil-water measurement, crop water use, irrigation scheduling, irrigation efficiency, measurement of water flow, irrigation systems, groundwater and wells, pumping systems, applying chemicals with irrigation systems, and environmental and water resource considerations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: FALL
Prerequisite for: AGEN 854, MSYM 854; AGEN 955, AGRO 955, CIVE 955, GEOL 985; MSYM 855

MSYM 462 Equipment Systems
Crosslisted with: MSYM 862
Prerequisites: Senior standing in MYSM
Notes: Capstone course.
Description: Team-based activities to evaluate equipment systems, make technical and economic recommendations, develop professional written and oral reports. Topics include equipment system performance and management, project scheduling and planning, cost estimation, reliability analysis, and risk assessment.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

MSYM 465 Food Engineering Unit Operations
Crosslisted with: FDST 465, FDST 865, MSYM 865
Prerequisites: FDST/MSYM 363.
Description: Unit operations and their applications to food processing.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

MSYM 469 Bio-Atmospheric Instrumentation
Crosslisted with: AGRO 469, GEOG 469, HORT 407, METR 469, NRES 469, AGRO 869, GEOG 869, HORT 807, METR 869, MSYM 869, NRES 869
Prerequisites: Junior standing; MATH 106; 4 hrs physics; physical or biological science major.
Description: Discussion and practical application of principles and practices of measuring meteorological and related variables near the earth's surface including temperature, humidity, precipitation, pressure, radiation and wind. Performance characteristics of sensors and modern data collection methods are discussed and evaluated.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

MSYM 475 Water Quality Strategy
Crosslisted with: NRES 475, NRES 875, SOCI 475, SOCI 875, SOIL 475, WATS 475, AGRO 475, AGRO 875, CIVE 475, CIVE 875, CRPL 475, CRPL 875, GEOL 475, GEOL 875, MSYM 875, POLS 475, POLS 875
Prerequisites: Senior standing.
Notes: Capstone course.
Description: Holistic approach to the selection and analysis of planning strategies for protecting water quality from nonpoint sources of contamination. Introduction to the use of methods of analyzing the impact of strategies on whole systems and subsystems; for selecting strategies; and for evaluating present strategies.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product

MSYM 479 Sustainable Agriculture Systems
Crosslisted with: AGRO 495, AGRO 895, AGRO 995, GEOL 869, METR 895, MECH 995, MECH 895, NRES 495, NRES 895, SOCI 495, SOCI 895, SOIL 495, SOIL 895, WATS 495, WATS 895
Prerequisites: Senior standing; AGRO/SOIL 153; AGRO 204.
Description: Case studies of successful application of information affecting crop management. Strategies for protecting water quality from nonpoint sources of contamination. Introduction to the use of methods of analyzing strategies for protecting water quality from nonpoint sources of contamination. Introduction to the use of methods of analyzing the impact of strategies on whole systems and subsystems; for selecting strategies; and for evaluating present strategies.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product

MSYM 490 Advanced Topics in Mechanized Systems Management
Crosslisted with: AGRO 490, AGRO 890, AGRO 990, GEOL 869, METR 890, MECH 990, MECH 890, NRES 490, NRES 890, SOCI 490, SOCI 890, SOIL 490, SOIL 890, WATS 490, WATS 890
Prerequisites: Senior standing in MYSM.
Description: Holistic approach to the selection and analysis of planning strategies for protecting water quality from nonpoint sources of contamination. Introduction to the use of methods of analyzing the impact of strategies on whole systems and subsystems; for selecting strategies; and for evaluating present strategies.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product
MSYM 492 Special Topics in Mechanized Systems Management  
Crosslisted with: MSYM 892  
Prerequisites: Permission  
Description: Subject matter in emerging areas of Mechanized Systems Management not covered in other courses within the curriculum. Topics, activities, and delivery methods vary.  
Credit Hours: 1-6  
Min credits per semester: 1  
Max credits per semester: 6  
Max credits per degree: 6  
Grading Option: Graded with Option  

MSYM 496 Principles and Problems in Mechanized Agriculture  
Crosslisted with: MSYM 896  
Prerequisites: 15 hours in MSYM or closely related area.  
Description: Individual or group projects in research, literature review, or extension of course work under the supervision and evaluation of a departmental faculty member.  
Credit Hours: 1-5  
Min credits per semester: 1  
Max credits per semester: 5  
Max credits per degree: 12  
Grading Option: Graded with Option  

MSYM 499H Honors Thesis  
Prerequisites: Admission to the University Honors Program and permission  
Notes: AGRI 299H recommended.  
Description: Conduct a scholarly research project and write a University Honors Program or undergraduate thesis.  
Credit Hours: 3-6  
Min credits per semester: 3  
Max credits per semester: 6  
Max credits per degree: 6  
Grading Option: Graded  

PLEASE NOTE  
This document represents a sample 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences to enrich your undergraduate education such as internships, education abroad, undergraduate research, learning communities, and service learning and community-based learning.

Mechanized Systems Management - Business  
Mechanized Systems Management - Processing Operations  
Mechanized Systems Management - Production  
Mechanized Systems Management - Technical  
Career Information  
The following represents a sample of the internships, jobs and graduate school programs that current students and recent graduates have reported.

**Jobs of Recent Graduates**  
- Operations Management LDP, Ardent Mills - Kenosha WI  
- Operations Supervisor, Cargill - Nebraska City NE  
- Production Supervisor, Land O'Lakes - Harrisburg PA  
- Operations Management, Union Pacific - Lincoln NE  
- Ag Services Operations Management, Archer Daniels Midland - Fremont NE  
- Technical Product Support Specialist, Orthman Manufacturing - Lexington NE  
- Marketing Representative - Product Support, John Deere - Waterloo IA  
- Field Test Engineer, AGCO Corporation - Hesston KS  
- Ag Specialist, JR Simplot Company - Scottsbluff NE  
- Product Support Technician, Lindsay Manufacturing - Lindsay NE

**Internships**  
- Ag Services Operations Intern, ADM Grain - Corpus Christi TX  
- Marketing Intern, John Deere - Urbandale IA  
- Operations Intern, Dow AgroSciences - York NE  
- Product Support Intern, John Deere - Ottumwa IA  
- Operations Intern, ConAgra Foods - Hastings MN  
- Agronomy/Crop Scout Intern, DuPont Pioneer -  
- Test Engineer Assistant, Global Industries - Grand Island NE  
- Equipment Testing Technician, CLAAS -  
- Plant Operations, Scoular - Omaha NE  
- Engineering Test Lab Intern, Exmark Manufacturing - Beatrice NE

**Graduate & Professional Schools**  
- M.S. Agricultural & Biological Engineering, Purdue University - West Lafayette IN  
- M.S. Mechanized Systems Management, University of Nebraska-Lincoln - Lincoln NE  
- M.S. Agricultural & Biological Systems Engineering, University of Nebraska-Lincoln - Lincoln NE  
- Ph.D. Engineering, Purdue University - Richmond IN  
- Ph.D. Engineering, University of Nebraska-Lincoln - Lincoln NE