



**Articulation Agreement  
Between Lake Superior State University and  
State-approved Career and Technical Education Programs in Michigan**

The purpose of this agreement is to encourage and support student transition from Career and Technical Education (CTE) Programs within Michigan to certificate, diploma and degree programs at Lake Superior State University (LSSU). Students from state-approved career technical programs will be eligible for 'articulated credit' from LSSU when they have fulfilled the following program requirements within two years of high school graduation. This agreement will remain in effect until the expiration date noted below; the agreement is renewable, and will remain in effect for admitted LSSU students for one additional year after the expiration date to permit admitted students access to the agreed upon credits.

**Requirements & Conditions:**

1. Candidates must have completed the state-approved Michigan CTE program described in this agreement. Candidates are required to meet minimum performance standards which include:
  - a. Minimum grade of "B" (3.0 on a 4.0 scale) or better in all CTE required courses for the two-year program
  - b. 90% or higher time in attendance during the program
  - c. Completion of state-assessments with a passing score when available, or other end-of-course exams, portfolios, etc.
  - d. Positive recommendations from the program instructors and CTE director
2. Candidates must submit a completed LSSU Application for Articulated Credit and all additional necessary documentation related to the successful completion of the CTE program
3. Within two (2) years of their high school graduation, candidates must be admitted to LSSU and successfully complete (earning a 'C' (2.0) or higher) the "next designated course" in the articulated program's plan of study before receiving articulated credits based on their CTE program
4. College tuition will not be charged for the articulated course(s) listed in this agreement; no grade will be recorded
5. CTE program must cover the content provided in the appendix of this agreement.

<b>State Approved Secondary Program:</b>	Mechatronics	<b>CIP Code Number:</b>	14.4201
<b>Michigan Career Pathway (Secondary):</b>	STEM	<b>Local Secondary Course:</b>	CTE Mechatronics
<b>Federal Career Cluster (Secondary):</b>	STEM	<b>Course Segment(s):</b>	
<b>PSN from CTEIS:</b>	20853		

<b>Lake Superior State University Program Name:</b>	Bachelor Degree: Robotics Engineering Credits also count as electives for Computer Engineering, Electrical Engineering, Mechanical Engineering, Manufacturing Engineering Technology, Electrical Engineering Technology and Mechatronics
<b>Articulated Course Equivalent(s):</b>	EGRS105 and EGRS215
<b>Post-secondary CIP Code:</b>	14.4201
<b>CREDIT TOTAL</b>	<b>3</b>
<b>Next Designated Course:</b>	EGNR101
<b>Perkins Approved:</b>	Yes

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CTE: \_\_\_\_\_ to LSSU: \_\_\_\_\_

Michigan Career and Technical Education		Postsecondary School	
Michigan Department of Education Career and Technical Education 608 W. Allegan Street - PO Box 30008 Lansing, MI 48909		Lake Superior State University 650 W. Easterday Ave, Sault Sainte Marie, MI 49783  <i>Lynn Gillette</i> Dr. Lynn Gillette, Provost	
<b>Effective Date:</b> August 1, 2022		<b>Expiration Date:</b> July 31, 2023	
		3/14/22 Date	

**Program of Study**

This plan of study should serve as a guide, along with other career planning materials, as you continue your career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals. All plans must meet high school graduation requirements as well as college entrance requirements. [http://www.michigan.gov/documents/HS\\_Plan\\_Arch\\_Cons\\_163096\\_7.pdf](http://www.michigan.gov/documents/HS_Plan_Arch_Cons_163096_7.pdf)

**High School/CTE Agency:** Rudyard Jr/Sr High School  
**State-Approved CTE Program Name:** Mechatronics  
**Secondary Program CIP Code Number:** 14.4201  
**PSN from CTEIS:** 20853

9 <sup>th</sup> Grade	10 <sup>th</sup> Grade	11 <sup>th</sup> Grade	12 <sup>th</sup> Grade
English 9	English 10	English 11	English 12
Algebra I	Geometry	Algebra II	CTE for Math Experience
US History	Civics (semester 1) & Econ (semester 2)	World History	Elective
PE	Physical Education (semester 1) & Health (semester 2)	Elective	Elective
Physical Science	Biology	Chemistry/ Anatomy/Physics	Elective
French 1	CTE Mechatronics	CTE Mechatronics	CTE Field Experience or Year 2 of CTE
Intro to CTE	CTE Mechatronics	CTE Mechatronics	CTE Field Experience or Year 2 of CTE

Lake Superior State University Degree:

<b>Fall semester – Year 1</b>	<b>Spring semester – Year 1</b>
CHEM-115 General Chemistry (5)	EGRS-105 Applications and Trends in Robotics (1)
EGME-141 Solid Modeling (3)	EGEE-125 Digital Fundamentals (4)
EGNR-101 Introduction to Engineering (2)	EGNR-140 Linear Algebra and Num Methods for Engineers (4)
ENGL-110 First-Year Composition I (3)	ENGL-111 First-Year Composition II (3)
MATH-151 Calculus I (4)	MATH-152 Calculus II (4)
<b>Fall semester – Year 2</b>	<b>Spring semester – Year 2</b>
EGEM-220 Statics (3)	EGNR-265 "C" Programming (3)
EGRS-215 Introduction to Robotics (3)	EGEE-210 Circuit Analysis (4)
MATH-251 Calculus III (4)	MATH-310 Differential Equations (3)
PHYS-231 Applied Physics for Engineers and Scientists I (4)	PHYS-232 Applied Physics for Engineers and Scientists II (4)
Communication Elective (3)	Social Science Elective (3)
<b>Fall semester – Year 3</b>	<b>Spring semester – Year 3</b>
EGRS-365 Programmable Logic Controllers (4)	EGRS-385 Robotics Engineering (4)
Technical Elective (3)	EGRS-372 Mobile Robotics (4)
MATH-308 Probability and Mathematical Statistics (3)	Free Elective (3)
EGNR-340 Adv. Numerical Methods for Engineers (1)	Technical Elective (3)
Support Elective (3)	Humanities Elective (3)
<b>Fall semester – Year 4</b>	<b>Spring semester – Year 4</b>
EGRS-430 System Integration and Machine Vision (4)	EGRS-435 Automated Manufacturing Systems (3)
EGRS-460 Control Systems (4)	EGNR-495 Engineering Design Project II (3)
EGNR-491 Engineering Design Project I (3)	EGRS-300 Collaborative Robotics and Safety (3)
Social Science Elective (3)	Cultural Diversity Elective (3)
Free Elective (1)	Humanities Elective (3)

**For students choosing to seek an Bachelor's Degree:**

LSSU graduation requirements for the bachelor degree include minimum credits by category and overall. Adjust your specific academic plan based your particular career path. General Education Core Requirements (Bachelor's Degree) - Effective as of Spring Semester 2021: Total Credits Required = 34-36

<http://webteam.lssu.edu/catalog/cmscatalog2021/gen-ed-requirements.php>

- **Oral and Written Communication Skills:** ENGL110, ENGL111, COMM101
- Mathematics (Minimum 3 credits): MATH110 or higher
- 22-24 additional General Education credits are required (chosen from at least two of the following categories listed above: Humanities, Natural Science, Social Science, or Diversity)
- A Bachelor of Applied Science requires the same Oral/Written Communication credits and Mathematics credits as noted in the bullet above, with 22-24 additional General Education credits chosen from the following categories: Humanities, Natural Science, Social Science, or Diversity.

A minimum of 124 credits (at the 100 level or higher) must be earned, with a cumulative gpa of 2.00 or higher. A 2.00 gpa or higher is required within your Major, as well as in your General Education Core Requirements.

The CTE program will cover the following content:

- Arduino programming for wheeled differential drive robot like BOT-Bot.
- Integration of Sensors and Motors using Arduino
- History of Robotics
- Parts of Robotic Systems
- Robotics Applications
- Robot Classifications
- Robot Safety
- Overview of Manipulator Kinematics
- Overview of Autonomous Vehicles Kinematics
- Description of LSSU's Robotics Engineering curriculum.
- Overview of applications of robots in the manufacturing industry.
- Overview of applications of robots in the service industry (military, medical, construction, agriculture, etc.)
- Overview of Human robot collaboration using collaborative robots - including safety issues.
- Current and future trends in robotics (data from the International Federation of Robotics).
- Political and sociological implications in the use of robots.
- Job opportunities and career growth in robotics with data from the Bureau of Labor Statistics.
- Humanoid robots – their development and relevance in society.
- Overview of drones including on board sensors, communication, and applications
- Autonomous navigation of drones through GPS points and an overview of the Ardupilot mission planner.
- Overview of the controls and functionality of above water and underwater robots.
- Applications and trends in the use of underwater robots and ROVs.

Therefore, at the conclusion of the CTE course, the student should be able to:

1. Explain or describe robotic terms, major components of a robot system, principles of robot operation, robot tooling, workspace, coordinates, and joint parameters
2. Describe the different types of sensors commonly used with robotic systems and explain how they work
3. Describe typical applications of robots and identify the challenges that those applications present to robotic systems
4. Construct programs for robots to carry out a specific task
5. Describe the various applications of robotics in the manufacturing industry and service industry and interpret data on the future trends in the robotics field.
6. Describe the applications and functionality of air-borne and water-borne mobile robots using drones and underwater vehicles (ROVs) as examples.